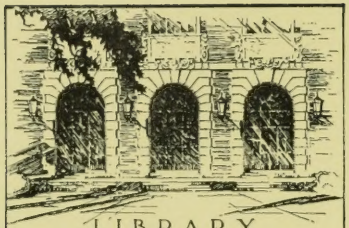


LIBRARY
OF THE
UNIVERSITY
OF ILLINOIS

574.9
B22n
v.4

OCT 9 1961

BIOLOGY

EDITOR'S AUTOGRAPH COPIES

HAND BOUND

LIMITED TO TWO HUNDRED AND FIFTY SETS

No. 49

Digitized by the Internet Archive
in 2010 with funding from
University of Illinois Urbana-Champaign

http://www.archive.org/details/natureneighborse04bant

Nature Neighbors

JOHN JAMES AUDUBON EDITION

Limited to Two Thousand and Fifty Sets

COPYRIGHT 1903, BY A. W. MUMFOR

CORN.
(Zea mays).
About ½ Life-size.

(Opp. 678).

NATURE NEIGHBORS

Embracing

BIRDS, PLANTS, ANIMALS, MINERALS

In Natural Colors by Color Photography

Containing Articles by Gerard Alan Abbott, Dr. Albert Schneider, William Kerr Higley, Thomas Crowder Chamberlin, John Merle Coulter, David Starr Jordan, and Other Eminent Naturalists.
Edited by Nathaniel Moore Banta

Six Hundred Forty-eight Full-page Color Plates

Containing Accurate Photographic Illustrations in Natural Colors of Over Fifteen Hundred Nature Specimens

---

VOL. IV—MINERALS AND PLANTS

AMERICAN AUDUBON ASSOCIATION
CHICAGO

Copyright, 1914
By Nathaniel Moore Banta

CONTENTS

MINERALS

CHAPTER		PAGE
I	How the Earth Was Formed	9
II	Grand Canyon, Geysers, Etc.	17
III	Formation of Minerals and Gems	23
IV	Ores, Marbles, Etc.	25
V	Precious Stones	37

PLANTS

I	Flowers	59
II	Spices, Etc.	109
III	Medicinal Plants	125
IV	Forests	141
V	Fruits, Nuts, Etc.	149
VI	Mushrooms	185
VII	Miscellaneous Plants	199

Minerals

ACKNOWLEDGMENTS

The publishers wish to express their acknowledgment and appreciation of the courtesy of the following parties for the use of certain material in this volume: To Mr. A. W. Mumford for the articles from *Birds and Nature;* all unsigned articles from this source are marked with an asterisk. To Mr. John C. Mountjoy for permission to use the articles from the writings of Prof. Harold B. Shinn.

275

TERRACED ROCKS, YELLOWSTONE PARK.

COPYRIGHT 1900, BY A. W. MUMFORD, CHICAGO.

CHAPTER I

HOW THE EARTH WAS FORMED

JUST how the earth was formed at the outset is not certainly known. The most common view of men of science is that it was once in the form of a fiery gas. It is supposed that all the planets and satellites that now revolve around the sun were once a part of a common mass of gas in the form of a vast sphere which was very large and very hot. This gradually lost its heat and shrank as most bodies do when they cool. If it was not already whirling round at the outset it must have come to do so as it shrank, and as more and more of its heat was lost it rotated more and rapidly. At length it came to whirl so fast that the outer part, which was moving fastest, could no longer be held down to the surface, and so it separated in the form of a ring around the equator of the great sphere.

The main mass kept on cooling and shrinking and whirling faster and faster, and hence other rings separated. Each of these rings also kept on cooling and shrinking and is supposed to have parted at some point and gradually gathered together into a globe, but still in the form of fiery gas, even though it had lost much of its heat. But at last this globe of gas cooled so much that the main part of it became liquid. This was that part which afterwards became the solid part of the earth. It then had the form of lava. It was still too hot for the

UNIVERSITY OF ILLINOIS
LIBRARY

water to condense and hence it remained in the form of steam or vapor, forming a vast envelope all about the earth. There are supposed to have been many other vapors in the air at that stage, and it must have been very dense. But at length the globe of lava cooled so that the outer part crusted over, and this crust grew thicker and thicker as time went on. After a while it became cool enough to permit the water to condense on the surface and so the ocean began to be formed. The water grew in depth until nearly all the steam was condensed and many of the other vapors that had been in the air while it was so hot were condensed also. And this left the gases which cannot easily be condensed behind, and they formed the air much as it is today. And that is the way the atmosphere is commonly supposed to have come about.

But all this is theory. It cannot now be proved. But there are several great facts that fit in with it and make it seem as though it might be true. As wells and mines are sunk deep in the ground it is found that the earth grows warmer and warmer. Volcanoes pour out molten rock and this shows that it is very hot somewhere beneath them. Many of the mountains on the earth are really wrinkles in its crust, and it has been thought that these are caused by the cooling and shrinking of the globe.

It is because these and other things fit in so well with the theory that most scientific men have come to accept it as probably true. It is known as the Nebular theory. But there are other ways of explaining all these things, and perhaps it may be proven that there are better ways.

OCEAN WAVES.

COPYRIGHT 1900, BY A. W. MUMFORD, CHICAGO

Some scientists have supposed that the earth was formed by small masses or particles of matter gathered in from the heavens. On a clear night shooting stars may be seen quite often. These are little bits of stone or metallic matter shooting through space at high rates of speed, which strike the atmosphere and become hot. The earth also is moving at great speed—nearly nineteen miles per second. It is not strange then that when the little stranger collides with the earth it should "make the fire fly." Usually the outside is melted and carried away so fast that the little mass is entirely used up in a few seconds. It merely makes a little streak of light. But sometimes the mass is large enough to stand the waste and still reach the ground. In such cases it is found to be mainly stony matter and iron. No substance has ever been found in any of them which is not found in the earth. Only a few of these shooting stars or meteorites will be seen in looking at any one point in the heavens. But the earth is very large and there are many such points, and when these are taken all together it is found that the number of these little bodies which fall in a day is very large. It is estimated at twenty millions. But still they are small and do not add very much to the size of the earth. But as they are being constantly swept up from space and are growing fewer and fewer, and as this has been going on for a very long time, it is reasonable to suppose they may once have been much more abundant and that the earth then grew much faster by reason of them. It is thought by some that the earth may have grown up entirely by gathering them in, the idea being that it was itself once

only a little meteorite that succeeded in gathering the others in. It is commonly supposed, however, by those who hold this view, that the earth was formed from some special cluster of these meteorites that gathered together. It has been thought that perhaps the gas of the rings mentioned before may have cooled down into little solid particles before they were collected together and that they built up the earth. This brings the two theories together in a measure.

The planet Saturn, you know, has rings of this kind and they are made up of small solid bodies, and not of gas or liquid, as was once supposed.

If the earth was built up this way we must account for the heat in the interior, but this would come naturally enough. As the little bodies fell upon the surface they would strike hot. But unless they came fast they would cool off before others struck the same spot and the earth would not get very hot. But as they gradually built up the surface the matter below would be pressed together harder and harder because of the growing weight upon it, and this pressing together would make it hot. It is figured out that it would become very hot indeed, though this might not seem so at first thought, and that the volcanoes and mountains may all be explained in this way quite as well, and perhaps better, than in the other way. This is called the Accretion theory.

It may be that neither of these theories is right, and we will do well to hold them only as possible ways in which the earth may have been formed at the beginning. But, at any rate, the earth has been shaped over on the surface.

A MOUNTAIN LAKE

COPYRIGHT 1900, BY A. W. MUMFORD, CHICAGO

In a certain sense its outer part has been remade. And this concerns us more than the question of its far-off origin, because our soils, ores, marbles, and precious stones, as well as our lands and seas, are all due to this reshaping. In the deepest parts of the earth which we can get at for study, we find that it is made up of rocks of the granite class; not always granite proper, but rocks like it. What is below this in the great heart of the earth we do not know, except that it is very dense and heavy. Rocks of the granite class are formed under great heat and pressure, or by the cooling of molten rock material. They may be called the basement rock or great floor, on which all the other rocks near the surface are laid. They underlie all the surface, but at different depths. In some places they have been crowded up by the pressure that came from the shrinking of the earth, of which we spoke before, and so have come to be actually at the surface, except that soil, clay, sand, or gravel may cover them. Under about one-fifth of the land these rocks lie just below the clays, gravels, sands, and soils that occupy the immediate surface. Sometimes they come out to the actual surface, and may be seen in ledges or bluffs. But usually the soils, sands, gravels, and clays cover them up more or less deeply, but even then they are often struck in sinking wells.

Under the other four-fifths of the land they lie much deeper, often several thousands of feet, and there are spread over them sandstones, shales, and limestones. These are the rocks we usually see in the quarries and cliffs of the interior states. The materials to form these were

taken from the older rocks of the granite class by a process which is now going on—so we know how it is done. This is the way in which it takes place: The air, and the rains, and the water in the ground act upon the rocks, and cause them to soften and fall to pieces, forming soils, or sand, or little rock fragments. This material is gradually washed away by rains and floods. This does not usually quite keep pace with the softening; so the surface is covered with soil and other loose material. But it is little by little washed away, and carried down to sea, where it settles on the bottom, and forms layers of mud or of sand. The mud afterwards hardens, and becomes a kind of rock known as shale. The sands become cemented by lime or iron, or some other substance, and form a sandstone. The lime in the rocks that softened and decayed is chiefly dissolved out by the carbonic acid in the waters of the ground, and is carried away to the sea in solution. This lime is then taken up by sea animals to form their shells, skeletons, teeth, and other hard parts. Afterwards the animals die, and these hard, limy parts usually crumble more or less and form a bed of lime material, and later this hardens into limestone.

Some of the lime is also separated from the waters by evaporation or by other changes. You have noticed that on the inside of a tea-kettle there gathers a stony crust. This is made of the same material as limestone—indeed, it is limestone. It was dissolved in the water put in the tea-kettle, but as the water was heated and partly changed into steam it could no longer hold all the lime, and some or all of it had to be deposited. So, in a similar way,

A MOUNTAIN RIVER.

COPYRIGHT 1900, BY A. W. H. MEARD, CHICAGO

sea water is dried up by the sun and air, and deposits lime, and so beds of limestone are formed. You will readily see from what has been said why shales, sandstones, and limestones take the form of beds lying upon each other.

Now, away back towards the beginning, when the ocean was first formed, and some part of the earth was pushed up so as to form land, this process began, and has been at work ever since. The surface of the land has been moistened by the air and moisture, and then has been washed away to the ocean and laid down in beds. When these grew thick, and were pressed by the weight of the newer beds that were laid down on them, they hardened into rock again. And this has gone on for a very, very long time, and the beds of sandstone, shale, and limestone so formed have come to be many thousand feet thick in some places. The land would all have been worn away down to the level of the sea if the earth had not kept shrinking and wrinkling, or pushing up in places.

At different times, portions of what was once the ocean bottom have been lifted and have become land. If these beds are examined, they will be found to contain shells and corals and other sea animals which were buried in them when they were forming, and thus it is known that they were laid down under the sea. It is found also that the lower beds contain kinds of life different from those above, and the lower beds were, of course, formed first. So, by studying the sea-shells and other relics in the beds, from the lowest ones up to the highest ones, in the order in which they were formed, the various kinds of life that have lived in the sea from the beginning are found out.

The life at the beginning was simpler than it is now, and quite different in many respects. There were gradual changes from time to time, and many strange creatures appeared that do not live at present.

T. C. CHAMBERLIN,
Head Professor of Geology, U. of C.

GRAND CANON, COLORADO

COPYRIGHT 1900, BY A. W. MUMFORD, CHICAGO

CHAPTER II

GRAND CANYON, GEYSERS, ETC.

THE GRAND CANYON OF THE COLORADO

This morning we are ready to enter the mysterious canyon, and start with some anxiety. The old mountaineers tell us it cannot be run; the Indians say, "Water heap catch 'em." But all are eager for the trial, and off we go.

Entering Flaming Gorge, we quickly run through it on a swift current, and emerge into a little park. Half a mile below, the river wheels sharply to the left, and we turn into another canyon cut into the mountain. We enter the narrow passage. On either side the walls rapidly increase in altitude. On the left are overhanging ledges and cliffs five hundred, a thousand, fifteen hundred feet high.

On the right the rocks are broken and ragged, and the water fills the channel from cliff to cliff. Now the river turns abruptly around a point to the right, and the waters plunge swiftly down among the great rocks; and here we have our first experience with canyon rapids. I stand up on the deck of my boat to seek a way among the wave-beaten rocks. All untried as we are with such waters, the moments are filled with intense anxiety. Soon our boats reach the swift current; a stroke or two, now on this side, now on that, and we thread the narrow passage with exhilarating velocity, mounting the high waves, whose foaming

crests dash over us, and plunging into the troughs, until we reach the quiet waters below; and then comes a feeling of great relief. Our first rapid run! Another mile and we come into the valley again.

Let me explain this canyon: Where the river turns to the left above, it takes a course directly into the mountain, penetrating to its very heart, then wheels back upon itself, and runs into the valley from which it started, only half a mile below the point at which it entered; so the canyon is in the form of an elongated U, with the apex in the center of the mountain. We name it Horseshoe Canyon.

Last spring, I had a conversation with an old Indian named Par-ri-ats, who told me about one of his tribe attempting to run this canyon. "The rocks," he said, holding his hands above his head, his arms vertical, looking between them to the heavens, "the rocks h-e-a-p, h-e-a-p high; the water go h-oo-woogh, h-oo-woogh! water-pony (boat) h-e-a-p buck; water catch 'em; no see 'em Injun any more! no see 'em squaw any more! no see 'em papoose any more!" MAJOR J. W. POWELL.

OLD FAITHFUL GEYSER

This picture of the geyser in action illustrates some of the work of underground water. In this case, water accumulates some distance below the surface in a cavity which lies in or near a bed of rock which has only recently come to the surface and is still very hot. This water becomes heated until steam is formed. This steam expands and with explosive violence forces upward and out the water in

OLD FAITHFUL GEYSER.
(Yellowstone National Park.)

COPYRIGHT 1902, BY A. W. MUMFORD, CHICAGO.

NIAGARA FALLS.

COPYRIGHT 1900, BY A. W. MUMFORD, CHICAGO

the throat of the geyser. The whole operation is repeated periodically, as often as the proper conditions of temperature and pressure are met. That Yellowstone Park is a region of very recent volcanic activity is shown by its numerous active geysers and hot mud springs. In any elementary physical geography will be found an interesting account of volcanic action and the work of underground water, not only in such cases as those mentioned here, but also in the formation of caverns. H. B. SHINN.

NIAGARA FALLS*

Niagara Falls, the grandest cataract in the world, belong in part to the State of New York. Here the water of the Great Lakes, west of Ontario, is poured over a precipitous cliff about one hundred and sixty feet high, in two immense sheets, called the American and Horseshoe Falls, separated by Goat Island. These falls received the name Niagara from the aborigines, Ni-a-ga-ra meaning "thunder of waters." The roar created by the falls can be heard, under favorable conditions, at a distance of fifteen miles. There are three distinct falls. The Horseshoe Fall, so named on account of its crescent shape, is the largest, covering a distance of two thousand feet, and having a fall of one hundred and fifty-four feet; the American Fall, six hundred and sixty feet, and the Central Fall, two hundred and forty-three feet in width, each have a fall of one hundred and sixty-three feet. The volume of water is perpetually the same, no amount of rain or snow making any apparent change. This is conceded to be the grandest natural feature

in the world, providing a water power the limit of which is incalculable.

Of late years the extraordinary power of the falls has been adapted to the production of electricity, which has been distributed to various cities and towns within a radius of one hundred miles. Street cars and machinery of every kind are run by them, and, by new devices and more powerful dynamos, it is believed the field for the successful utilization of this great force is almost without limit.

OIL WELLS*

The Pennsylvania oil region and the Russian oil region are the two greatest centers of petroleum in the world. The latter has its center at Baku, on the Caspian Sea.

Oil is found in Pennsylvania in oil-bearing sand-rocks, which are considered as the reservoirs in which the distilled product has found a permanent lodgment. The depth of the oil-sand or sand-rock in this State is from 800 to 1,900 feet. There are often several strata, one above the other, containing oil.

It is the uniform experience that the lightest oils are found in the lowest sandstones, while the heaviest oils are drawn from the shallowest wells; and as we approach the surface, where it is gathered from the pools dug to the depth of only a few feet, it becomes sticky, semi-fluid, and finally a solid asphalt.

Man made no attempt to bore a deep hole through soil and rock, hundreds of feet down, to reach oil, until the summer of 1859. The first oil company was formed in

COPYRIGHT 1901, BY A. W. MUMFORD, CHICAGO.

OIL WELL.

1854, with Mr. George H. Bissel at its head, which bored the first oil well in the summer of 1859, under the direction of E. L. Drake.

The price of oil, when first put on the market, was about thirty-five cents a gallon at retail, or to the consumer. It has since been sold to the consumer at as low a price as seven cents a gallon.

The Standard Oil Company owned the first pipe lines that transported oil from the Pennsylvania oil fields to the sea coast. The American oil is said to be at least twenty-five per cent. superior to the Russian article. It is of a higher grade, and commands, naturally, a higher price.

It is assumed that there must still be great quantities of oil in the rock formation of the earth.

CHAPTER III

FORMATION OF MINERALS AND GEMS

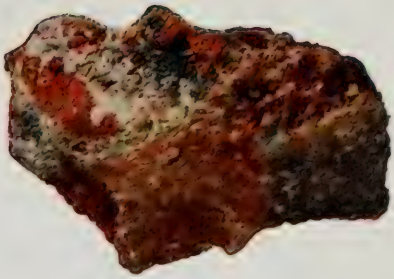
EVEN an elementary study of the forms here pictured and an investigation into their causes and histories would necessitate the compilation of a very elaborate text-book. Such would be properly called a mineralogy, and it would be used only in work of a collegiate character.

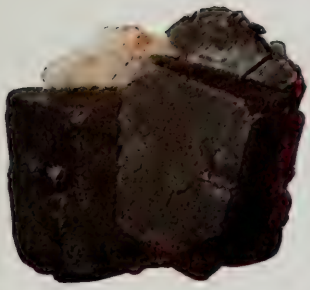
It is well known that the intensely heated interior of the earth is subjected to enormous pressure caused by the weight of the overlying rocks. With cooling comes the slow shrinking and contraction of the crust or outer portions. Under such conditions of heat and pressure, many substances are molten or fluid, but become hard if they reach the surface or otherwise become cool. An example of these is lava, which is poured in a more or less fluid condition from the craters of active volcanoes. While in the fluid condition there is a strong tendency for the ingredients of rock to gather together into masses of varying size, and these, upon cooling, form crystals. If the cooling be slow, the crystals have ample time for formation, and will, therefore, be large. By "slow" is meant a very long period of time—perhaps a thousand years. Examples of such formations are the diamond and the garnet, the pictures of both of which show both the central crystal and the surrounding material, called *matrix*. The colors of these gems are due to various ingredients such as iron,

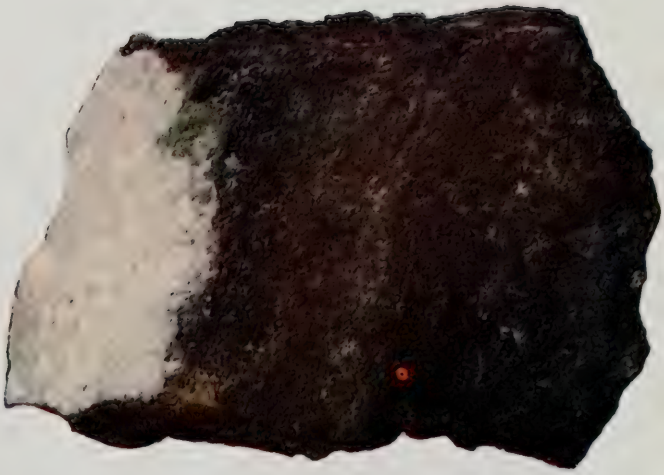
manganese, cobalt, etc. The white diamond is practically pure carbon.

It often happens, however, that when rocks solidify, cavities or pockets are formed, perhaps from gas bubbles, and into these there later penetrates water which is on its way upward to the surface from the great depths below. When under the influence of the intense heat and the enormous pressure of the interior, water will directly dissolve certain substances which ordinarily it would not, or it may dissolve certain minor substances, thus forming strong acids or alkalies, which further dissolve the most refractory materials. Through cracks, crevices, or sometimes open vents, this water, with its load of dissolved materials, slowly percolates, finally rising toward the surface. As the pressure and heat diminish the materials which cannot be carried in solution are deposited along the sides of the passageway or around the walls, and in cavities into which the water has penetrated. The crevices become filled and other channels may be opened at other places. In any event, the result is the formation of a mineral vein or a nodule, the characteristic structure of both of which is well illustrated in a number of the plates. The agate was probably made during a long period of time and the successive layers, being composed of unlike substances, formed bands of dissimilar colors. Such, in a very general way, is the story of the formation of a vein of gold-bearing quartz, of lead, of silver, and other materials, and that of the innumerable agates and carnelians.

H. B. Shinn.







ORES.
Full Size.

COPYRIGHT 1900, BY A. W. MUMFORD, CHICAGO

Cholcopyrite
Cerussite coating Galenite
Galenite

Anglesite
Native Copper
Chalcocite

CHAPTER IV

ORES, MARBLES, ETC.

COPPER AND LEAD ORES

NATIVE COPPER scarcely needs a description. Its occurrence in its free state provides an interesting subject of conjecture. Briefly stated, the question of origin is whether the copper was set free by the decomposition of silicates or was in the form of a sulphide in the rock. The chief region of occurrence of native copper is the Lake Superior district.

The ore chalcocite, sometimes called copper glance, has a metallic luster, often tarnished green or blue. It is commonly lead-gray and rather soft. Its streak is a blackish lead-gray. Chalcopyrite is a sulphide of copper and iron combined. When copper is much in predominance the color of the ore is golden yellow. The streak is dark green. The mineral is harder than chalcocite, but less hard than pyrite, being easily scratched with a knife. Both chalcocite and chalcopyrite frequently occur in silver-bearing rocks.

Lead occurs in nature chiefly in the forms of the sulphide, galenite or galena; the sulphate, anglesite, and the carbonate, and cerussite. Galena is lead-gray, quite soft, and frequently occurs in a coarsely crystalline condition, the crystals often being cubical. The luster is metallic, hence a superficial examination of a specimen might result in mistaking the mineral for the copper ore, chalcopyrite, already described. The streak will serve to identify any specimen,

however, it being a lead-gray of much lighter shade than that of chalcocite. Anglesite and cerussite are far less abundant than galena. The former varies from white through gray to yellow and has a resinous luster. Cerussite is white or gray, resembling anglesite, and has a brilliant, vitreous luster. Both minerals, like galena, are soft and easily scratched with a knife.

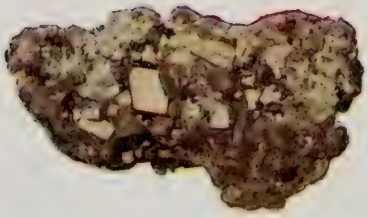
THEO. F. BROOKINS.

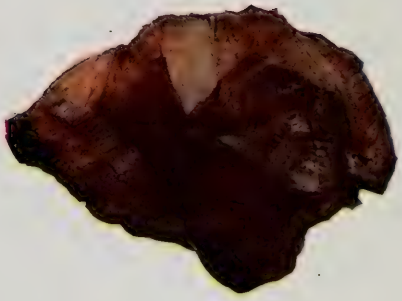
IRON ORES*

The sulphide of iron, Pyrite, occurs in many crystalline rocks, but, owing to the difficulty of separating the iron and sulphur, is not used as an ore of iron. The mineral much resembles in external appearance a yellow ore of copper, called chalcopyrite, from which it may be distinguished in that it will strike fire with steel.

The black oxide of iron, Magnetite, occurs widely distributed. As its name indicates, it sometimes displays the properties of a magnet.

In a series of ore beds formerly operated by a mining company of northern New York four distinctions of the crude ore were made, two varieties of blue, one of black, and one of gray. The blue coloring is apparently due to the presence of impurities, the black ore is evidently magnetite, and the steel gray mineral, failing in the characteristic properties of magnetite, finds its class place under Hematite. Hematite differs from magnetite in representing a higher degree of oxidation. It is often found, as indicated above, in beds distributed in close conjunction





Pyrites
Limonite
Hematite

IRON ORES.

Magnetite

COPYRIGHT 1900, BY A. W. MUMFORD, CHICAGO

Pyrites
Limonite
Specular

ORES.

Specimens at top of page are gold bearing rock.

Native Copper.

Tin Ore. B. H.

Lead Crystals.

Silver Quartz.
Nickel Pyrites
Spathic Iron Ore.

Kidney Iron Ore.

Zinc Ore

Blue Carbonate Copper.
Needle Iron Ore.

with those of magnetite. This ore is a valuable source of iron. Hematite commonly occurs in earthy materials, as red ochre. Its streak is red. All rocks of a reddish or red color owe the color to this oxide of iron.

When hematite rusts, the brownish-yellow or yellow iron oxide, Limonite, results. The streak of limonite is yellow, thus distinguishing it from hematite. Disseminated through beds of clay, limonite gives them the characteristic yellow color. Such clays turn red when heated, since the water of the limonite is driven off, leaving hematite as a residue. This is the explanation of the usual coloring of bricks. Yellow ochre is impure, or earthy, limonite.

ORES *

Nickel is a silver-white, ductile metal discovered by Cronstedt in 1751. It is closely allied to iron and cobalt, and is associated with many ores. Nickel, according to Deville, is more tenacious than iron. It is magnetic at ordinary temperatures. Many of the copper coins of the European continent and the United States are alloys containing various proportions of nickel. Nickel-plating has become an industry of great importance in the United States. It is used for magnetic needles, for philosophical and surgical instruments, and in watch movements.

Spathic Iron Ore. — Carbonate of iron, when found in a comparatively pure and crystallized state, is known as spathic or sparry. In its purest form it contains 48 per cent. of iron. The ore is found near Hudson, N. Y., and in Tuscarawas County, Ohio.

Copper. — Copper is one of the most anciently known metals, and its name is derived from the island of Cyprus, where it was first obtained by the Greeks. In the earlier times it does not appear to have been employed by itself, but always in admixture with other metals, principally tin, forming bronze. Great masses of native copper have been found both in North and South America.

Tin. — Tin is a beautiful silver white metal with a tinge of yellow. The pure mineral is colorless, and it is very scarce; most specimens are brown, owing to the presence of ferric or manganic oxide. The faces of the crystals exhibit diamond luster. There is also another form, known as "wood tin," occurring in roundish masses with a fibrous radiating fracture.

Zinc. — A metal of a brilliant white color, with a shade of blue, and appearing as if composed of plates adhering together. It is not brittle, but less malleable than copper, lead, or tin; when heated, however, it is malleable, and may be rolled into plates.

Lead. — A metal of a dull white color, with a cast of blue. It is soft and easily fusible. It is found native in small masses, but generally mineralized by sulphur and sometimes by other substances. It is the least elastic and sonorous of all the metals.

MINERALS CONTAINING CARBON

Among minerals of economic importance, carbon minerals hold the unique position of being at the same time of the most common and the most rare occurrence. As far as

FROM COL. CHI. ACAD SCIENCES
C. MUMFORD, PUBLISHER, CHICAGO
0

CARBONS.

Anthracite Coal

Bituminous Coal

Graphite

COPYRIGHT 1900, BY
NATURE STUDY PUB. CO., CHICAGO.

external appearance indicates, a piece of common coal and the most brilliant diamond are widely separated; with regard to chemical composition they are closely related. Intermediate between the coal of the stoke furnace and the "brilliant" of the jewelry shop is still another well-known form of carbon, the graphite of the lead pencil. These three substances comprise the far greater part of carbon-containing minerals.

Vegetation is, undoubtedly, the origin of all coal, but often much more than a cursory examination is necessary to prove such origin. In the less altered coals the vegetable origin is readily proved by the actual presence of seeds, plant fibers, and other equally apparent organic remains. A microscopic study is necessary for finding the presence of woody fiber in the more metamorphosed form.

In America, bituminous or soft coal was mined to a slight extent in the latter half of the eighteenth century. The form now commonly used in house-heating furnaces, anthracite, for a long time baffled the colonists in their efforts to make it burn. The knowledge that an anthracite fire is most effective if not continually poked is said to have been acquired generally by accident.

Europe and the United States today produce practically all the coal of the world.

The purest form of carbon found in nature is the diamond. The rare occurrence of diamonds indicates that the essential conditions in nature for causing the transformation of some less pure form of carbon into diamond are seldom present.

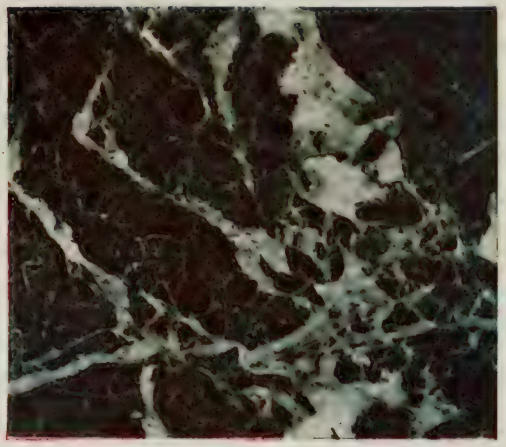
THEO. F. BROOKINS.

MARBLES

At one early period of the geological history of the North American continent all that portion now occupied by the Appalachian mountain system was sea bottom, and on it was being deposited not merely sediments washed down from the land, but, in favorable localities, deposits of lime, sand, and mud. This deposit went on, on a gradually sinking floor, for long ages, until the lowermost beds were buried under thousands of feet of the later formed materials. Then began the slow uplifting of the sea bottom in the form of long, parallel folds to form the mountain ranges. During this uplifting the lime sediments, which are the only ones we need consider here, were changed to marbles, and have since been exposed and made available to the quarriers through the wearing-down action of rain and running streams. So, then, a quarry is but an excavation in the hardened mud formed on the bottom of a very ancient sea.

In the Vermont marble region the beds are highly inclined and of varying colors. From the same quarry there may be produced pure white, gray, blue-gray, and greenish varieties, often variously veined and blotched, owing to the collection of their different impurities along certain lines. Some of these quarries have been worked a depth of two hundred feet and more.

Not all marble beds are upturned at this steep angle, however, nor have they been worked so deeply. In Georgia the quarries are often in hillsides, extending scarcely at all,



MARBLES.

Old Tennessee.
Sienna.
Florentine Vermont.

Alps Green
Mexican Onyx.
African Marble

if any, below the surface of the ground. Where opened in the valley bottoms they have the form of huge rectangular pits with perpendicular walls. In Tennessee many of the sediments were so slightly changed that the fossil remains are still easily recognized, and the stone is of a pink or chocolate red color, owing to the abundance of iron.

The marbles are quarried mainly by channeling machines, which cut out the stone in blocks of any desired size, or at least in sizes such as the nature of the beds will allow. Blasting is never resorted to in a properly managed quarry, since the shock of the explosion is likely to develop flaws in so tender a material. When freed from the quarry bed and brought to the surface the stone is sawn into the desired shapes by means of "reciprocating" blades of soft iron, the cutting material being sand washed under the blades by small jets of water.

The use to which any particular marble is put is governed largely by its price and color, though texture or grain often is taken into consideration. The coarsely crystalline white and white clouded marbles of southern New York, Maryland, and Georgia are almost wholly for building purposes; the pink and variegated marbles of Tennessee for interiors and for furniture, while the white and blue-grays of Vermont find a large market for interiors, cemetery work, tiling, and, to a much smaller extent, for building.

GEORGE MERRILL.

MINERALS *

Malachite. — One of the native carbonates of copper. It is sometimes crystallized, but more often occurs in concretionary masses of various shades of green, which are generally banded or arranged in such a manner that the mineral, which takes a fine polish, is much prized as an ornamental stone. Great quantities of it are found in the Siberian mines, and many beautiful objects are manufactured from it.

Quartz. — The most abundant of all minerals, existing as a constituent of many rocks, composing of itself the rock known as quartzite or quartz rock and some of the sandstones and pure sand, forming the chief portion of most mineral veins. In composition it is silica, and when uncontaminated with any foreign intermixture it appears in clear, transparent crystals like glass or ice. Pure quartz is largely employed in the manufacture of glass, and is commonly obtained for this purpose in the form of sand. Quartz veins, with few exceptions, form the gangues in which gold is found.

Tourmaline. — A name applied to a group of double silicates composed of many other minerals. The color of tourmaline varies with their composition. The red, called rubellite, are manganese tourmaline containing lithium and manganese, with little or no iron; the violet, blue, and green contain iron, and the black are either iron or magnesium-iron tourmalines. Sometimes the crystals are red at one extremity and green at the other, or green internally

Hornblendt.
Crocidolite.
Malachite.

MINERALS.

Rose Quartz.
Pink Tourmaline Rubellite.
Agate.

Amethyst
Serpentine
Sulphur

and red externally, or *vice versa.* Pink crystals are found in the island of Elba. Tourmalines are not often used in jewelry, although they form beautiful gems and bear a high price. A magnificent group of pink tourmalines, nearly a foot square, was given by the King of Burmah to Colonel Sykes while commissioner to his court. The tourmaline appears to have been brought to Europe from Ceylon by the Dutch about the end of the seventeenth century, and was exhibited as a curiosity on account of its pyro-electric properties.

AGATE. — Of the quartz family, and is one of the modifications in which silica presents itself nearly in a state of purity. Agates are distinguished from the other varieties by the veins of different shades of color which traverse the stone in parallel concentric layers, often so thin as to number fifty or more to an inch. Externally the agates are rough and exhibit no appearance of their beautiful veined structure, which is exposed on breaking them, and still more perfectly after polishing. Though the varieties of agate are mostly very common minerals in this country as well as in the old world, those localities only are of interest which have long been famous for their production and which still furnish all the agates required by commerce.

AMETHYST. — So named because it was supposed by the ancient Persians that cups made of it would prevent the liquor they contained from intoxicating. The stone consists of crystallized quartz of a purple or blue violet color, probably derived from a compound of iron and soda. The color is not always diffused through it, and is less brilliant by candle light.

SERPENTINE. — Serpentine differs in composition from the other marbles. It is a soft mineral of different shades of green, of waxy luster, and susceptible of a high polish. It is better adapted to ornamental work within doors than to be exposed to the action of the weather.

SULPHUR. — An elementary substance belonging to the class of metalloids. It has been known from the earliest times as the product of volcanoes and as a natural mineral deposit in clay and marl formations. It also exists in primitive rocks, as granite and mica.

HORNBLENDE. — A mineral species placed by Dana in the augite section of the anhydros silicates. In common use the name is limited, as it was formerly applied only to the dark crystalline minerals which are met with in long, slender prisms, either scattered in quartz, granite, etc., or generally disseminated throughout their mass. The color of the mineral is usually black or dark green, owing to the presence of much iron. It appears to have been produced under conditions of fusion and cooling which cannot be imitated in the laboratory, the crystals obtained artificially being of augite type.

CROCIDOLITE. — A mineral occurring in silky fibers of a lavender blue color. It is related to hornblende and is essentially a silicate of iron and soda; — called also *blue asbestus*. A silicified form, in which the fibers penetrating quartz are changed to oxide of iron, is the yellow-brown *tiger-eye* of the jewelers.

QUARTZ AND SILICATES.
¼ Life-size.

CO-YRIGHT 1900, BY A. W. MUMFORD, CHICAGO

1—Asbestus. 2—Feldspar. 3—Quartz Crystal. 4—Small Garnets in rock. 5—Garnet. 6—Opal. 7—Smoky Quartz.

QUARTZ AND THE SILICATES

Comparatively few persons associate the gem opal, with its brilliant internal colored reflections, with that material forming so large a part of the soil, sand. Yet the two are almost identical in composition. The mineral constituent of sand and of opal is quartz, though the latter often contains in addition some water.

Quartz is composed of the two elements occurring the most abundantly in the earth's crust, silicon and oxygen, both non-metals. As already indicated, the most common representative of the mineral substance is the sand of the soil. The sand grains are generally so eroded by the atmosphere and surface waters as to show little of the true quartz structure. As studied by means of the rock crystal, quartz is remarkable for its transparency, its regular crystal form, and its great degree of hardness. Its transparency is such that printing may be read through the crystal. Its crystalline form affords an unfailing means to the mineralogist of recognizing the substance as quartz.

Quartz has an economic value directly in glass sand, and, of course, as a soil constituent. In the latter capacity it is taken up by many plants, and is the silica that studs the saw edges of the blades of sedges and grasses. The precious stones, agate, amethyst, and jasper, are varieties of quartz.

The silicon that is so important a constituent of quartz composes with aluminum a large part of various minerals comprised under the name feldspar. This substance is

slightly less hard than quartz and has many variations in color, but, unlike quartz, shows regular cleavage faces. Feldspar is always crystalline, but good crystals are not common. It is very difficultly soluble, yet readily yields to the influence of weathering. THEO. F. BROOKINS.

FROM BAUER'S EDELSTEINKUNDE.

COPYRIGHT 1902, BY A. W. MUMFORD, CHICAGO

DIAMOND AND CORUNDUM.

Sapphire Crystal.
Ruby Crystal.

Bort.

Diamond in Matrix (Brazil).

Diamond in Matrix (South Africa).

Spinel Crystal, Rubicelle.

Cut Sapphire.
Cut Ruby.

Black Diamond, Carbonado (Brazil).

Spinel Crystal, Balas-ruby.

CHAPTER V

PRECIOUS STONES

By Oliver Cummings Farrington

THE DIAMOND

The Diamond is generally conceded to be the most beautiful, as it is the most important, of precious stones. While other stones at times exceed it in value, weight for weight, in total importance as an article of commerce other gems are hardly to be compared with it. Out of thirteen and one-half millions of dollars' worth of precious stones imported into the United States in one year, twelve million dollars' worth were diamonds. Not all this amount was employed for jewelry, since there is a large utilization of the stone for industrial purposes; but even for jewelry the diamond has a largely preponderating use. Its points of superiority are its hardness, high refractive powers, and, hence, play of colors, its transparency, and its luster. In all these qualities it excels any other known mineral. Hence, when, in addition to these, it exhibits different body colors, as is sometimes the case, no other gem can equal it in value.

Usually the diamond is colorless or white, although shades of yellow are also common. It is also known in shades of red, green, and blue, and in brown and black. The two latter are rarely transparent and grade into the varieties known as bort and carbonado, which have no value as gems but are highly important for industrial purposes.

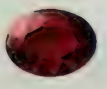
In composition the diamond is pure carbon, thus not differing chemically from graphite or such forms of carbon as lamp-black, bone-black, etc. It is crystallized, but this can be said of graphite as well. Why carbon should assume the form of diamond in one case and graphite in another, as well as being amorphous in other occurrences, is not known. Such behavior of a substance is known as dimorphism, and numerous illustrations of it are to be found in nature.

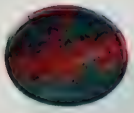
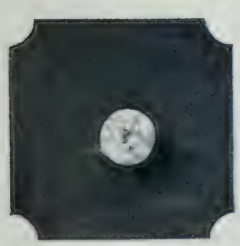
BIRTH STONES

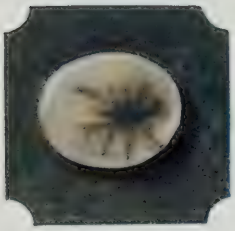
As to the particular stone which is to be considered appropriate to each month, usages differ. Such differences have doubtless arisen from the desire to introduce gems which were formerly little known or unattainable on account of their cost as substitutes for stones formerly prized but now held of little value. Thus, the precious opal, now much admired, was hardly known in former times. By some it is now used as the birth stone of the month of October, while others retain the beryl. The diamond has been introduced in modern practice in quite a similar way. The carnelian and chrysolite, by some still used for the months of August and September, are stones held of little worth at present, and, hence, others are usually substituted.

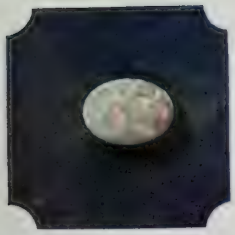
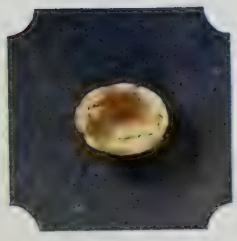
The particular order and kind of stones adopted in the accompanying plate is given in accordance with a pamphlet first published by Tiffany & Company, of New York, in 1870:

January, Garnet; February, Amethyst; March, Bloodstone; April, Diamond; May, Emerald; June, Agate; July,





S LOANED BY FREDERICK J. ESSIG

BIRTH STONES.

Garnet (January.
Diamond (April.
Ruby (July.
Opal (October.

Amethyst (February.)
Emerald (May.)
Sardonyx (August.
Topaz (November.)

Bloodstone (March.
Agate (June.
Sapphire (September.
Turquoise (December.

COPYRIGHT 1908, BY A. W. MUMFORD, CHICAGO

Chlorastrolite, polished (Isle Royale).
Hematite, polished (England).
Thomsonite, polished (Lake Superior).

Cat's-eye, Quartz, polished (Ceylon).

Variscite, polished (Utah).
Moldavite, cut (Bohemia).
Thomsonite, rough (Lake Superior).

Ruby; August, Sardonyx; September, Sapphire; October, Opal; November, Topaz; December, Turquoise.

MINOR GEMS

The stones represented in the accompanying colored plate have, for the most part, but limited use, either because of their local occurrence or their lack of special gem qualities. Three of them are peculiar to the United States, and deserve on that account, perhaps, to be better known and more widely used by our people. These are variscite, chlorastrolite, and thomsonite.

Variscite. — Variscite resembles turquoise in many properties, being, like that mineral, a generally opaque, hydrous phosphate of aluminum not occurring in distinct crystals. Its color is, however, normally an apple-green to emerald-green, rather than blue, and its luster is more nearly vitreous than that of turquoise.

Chlorastrolite. — This mineral, the name of which means "green star stone," is solely of American occurrence, and thus far has been found at but a single locality. It occurs at Isle Royale, an island in Lake Superior, in the form of peach pebbles.

Thomsonite. — An occurrence of this mineral, which is used ornamentally to some extent, is obtained, like chlorastrolite, in the form of water-worn pebbles weathered out of an amygdaloidal trap. The pebbles are found on the shores of Lake Superior, near Grand Marais.

Moldavite. — This term is applied to a transparent green stone found occurring in small pieces in Bohemia, in

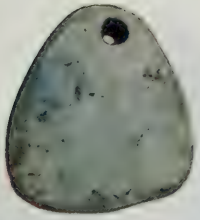
the region drained by the river Moldau, whence the name Moldavite. The color of the stone is of the peculiar character generally designated as bottle green.

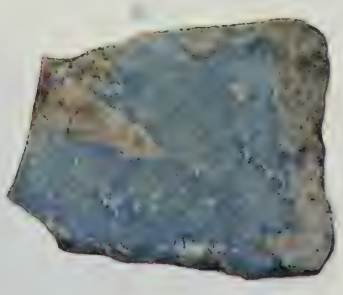
HEMATITE. — Hematite is an oxide of iron which takes on a variety of forms and shades, but is used in jewelry only when compact and of an iron-black color. In this form it is used especially for intaglios, but also for carving into ornaments of various sorts.

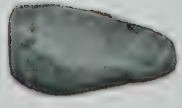
TURQUOISE

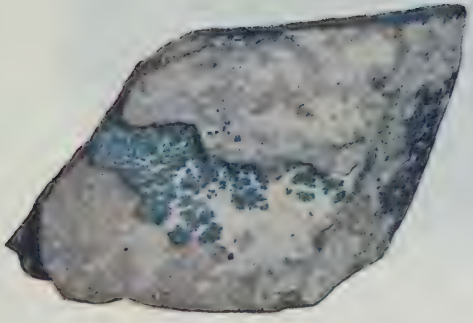
This mineral differs from nearly all others held in favor as gems in not being transparent and never occurring in the form of well-defined crystals. The opal is perhaps the only other gem of which the same may be said. In composition Turquoise is a hydrous phosphate of aluminum, the percentages being: Of water, 20.6 per centum; of alumina, 46.8 per centum, and of phosphoric oxide, 32.6 per centum. Thus, in composition as well as opacity turquoise differs from most other gems, they being usually silicates or some form of silica. Besides the above ingredients, turquoise always contains a small percentage of copper oxide and, usually, iron, calcium, and manganese oxides in small amount. It is the copper compound which undoubtedly gives turquoise its inimitable color, that color to which it owes its chief charm as a gem. The color varies from sky-blue through bluish-green and apple-green to greenish-gray.

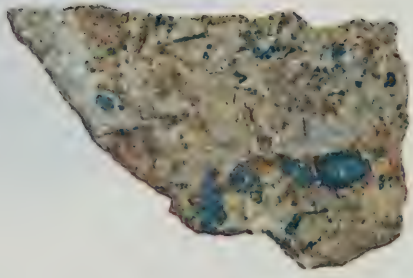
Of these colors, the pure sky-blue or robin's-egg blue is by far the most highly prized, and is, in fact, the only











SPECIMENS LOANED BY FOOTE MINERAL CO.

TURQUOIS.

(New Mexico.)

COPYRIGHT 1901, BY A. W. MUMFORD, CHICAGO.

Indian Amulet.
Artificially polished.
Natural.

Waterworn.
Waterworn.

Artificially polished.
Artificially polished.
Natural.

LOANED BY FOOTE MINERAL CO.

OPAL.

COPYRIGHT 1902, BY A. W. MUMFORD, CHICAGO.

Precious Opal in Matrix (Queensland.)
Precious Opal (New South Wales.)

Wood Opal (Idaho.)
Precious Opal (New South Wales.)
Prase Opal (Germany.)

Precious Opal (New South Wales.)
Fire Opal in Matrix (Mexico.)

standard color for the gem. Green is, however, the most common and the most lasting color of the mineral, and it is one of the faults of the gem that the blue shades often fade to green after being exposed to the light for a time. In a stone of first quality, however, especially a Persian turquoise, such fading of color is exceptional. A good turquoise also maintains its color in artificial light. The hardness of turquoise is 6, in the scale of which quartz is 7. It is, therefore, somewhat more easily scratched than other gems. Its specific gravity varies from 2.6 to 2.8, being about that of quartz. It does not fuse before the blowpipe, but turns brown and assumes a glossy appearance. By the copper of the turquoise the blowpipe flame is usually colored green. When heated in a closed glass tube the mineral turns brown or black and gives off water.

OPAL

"The Opal, when pure and uncut in its native rock," says Ruskin, in his lecture on Color, "presents the most lovely colors that can be seen in the world except those of clouds."

The opal is indeed one of the most fascinating of gems, yet often elusive and at times disappointing. Of its freaks and foibles strange stories are told. Gems of brilliant quality are known suddenly to have lost their hues never to regain them, while others previously dull and lusterless have become radiant as the rainbow.

Chemically, opal is oxide of silicon with varying amounts of water, the water varying from 3 to 9 per cent. It is,

therefore, closely allied to quartz, but differs physically in being softer and not as heavy. Further, it never crystallizes, and it is soluble in caustic potash, which quartz is not. It is infusible, but cracks and becomes opaque before the blowpipe. In sulphuric acid it turns black, on account, probably, of the organic matter it contains.

Opal as a mineral is quite common, so that no one need suppose, because he has specimens labeled "opal" in his collection, that he has as many precious stones. It occurs in many varieties, and, especially if it contains foreign matter, in many colors. Nearly all silica deposited by hot waters is in the form of opal, so that the geysers of Yellowstone Park build up cones of opal and fall into opal basins. This particular form of opal is known as geyserite, and it is often differently colored by different ingredients.

Wood is often preserved by silica in the form of opal, the siliceous waters taking away the wood and replacing it by opal, grain by grain, with such delicacy and accuracy that the structure of the wood is perfectly maintained.

CHRYSOLITE

This mineral is known among the gems by many names. It is often called Chrysoberyl by jewelers, while the true chrysoberyl is called Chrysolite. It is also known by different names, according to its color, it being called peridot when of a deep olive-green, olivine when of a yellowish-green, and chrysolite when of a lighter or golden-yellow color. The name chrysolite means gold stone. One feature distinguishing chrysolite from most other gems is its rela-

FROM BAUER'S EDELSTEINKUNDE

Almandine Garnet (Alaska).

Essonite Garnet, cut.
Demantoid Garnet, cut.
Demantoid Garnet (Ural Mts.).

Almandite Garnet, cut.

"Cape Ruby," cut.

Essonite Garnet and Diopside (Italy).
Chrysolite crystal.

Epidote (Knappenwand, Austria).

Epidote, cut.
Chrysolite, cut.
Pyrope Garnet (Bohemia).

tively low hardness, which is 6¾. It will thus scratch feldspar, but is scratched by quartz and most other gems. Again, it is relatively heavy, its specific gravity being between 3.3 and 3.4. Its luster, too, while vitreous, has a slightly oily tinge, which can be detected by a little experience. Chrysolite is easily dissolved by the common acids. In composition it is a silicate of magnesium and iron, the relative percentages of the two latter elements varying.

EPIDOTE

This is a mineral possessing several interesting characters and having many qualities desired in gems, yet its use in jewelry is very limited. It is comparatively common as one of the constituent minerals of metamorphic rocks, but in its ordinary occurrences it is not suitable for gem purposes. It is only when occurring in large transparent crystals that pieces suitable for cutting can be obtained. Its peculiar green color is one of its most striking characteristics, enabling it nearly always to be recognized. This color is a yellowish-green known as pistachio green and is hardly possessed by another mineral. It frequently, however, shades to black, on the one hand, and brown, on the other, so that it cannot be taken alone as a criterion for determination. Epidote is quite strongly pleochroic—that is, it exhibits different colors in different directions, being often green in one direction, brown in another, and yellow in another.

GARNET

This stone exhibits many varieties of color and of composition. The color probably most often thought of in connection with it is dark red, but it would be a mistake to suppose this the only color which it may manifest. Green, red, rose, and brown are other colors which garnet transparent enough to be used as gems exhibits, while among opaque garnets may be found black and many varieties of the shades above mentioned.

These variations of color are more or less connected with differences of composition which it may be well first of all to consider. Garnet as a mineral is, like most minerals used as precious stones, a silicate. United with the silica, the element most commonly occurring is aluminum. If calcium be united with these two, the variety of garnet known as grossularite, or essonite, or cinnamon stone, is produced. If magnesium takes the place of calcium, then pyrope is formed. If iron, we have almandite, and, if manganese, spessartite. Another variety of garnet, andradite, is composed of calcium and iron in combination with silica, and still another, uvarovite, of calcium, chromium, and silica. Though they seem to differ so much in composition, all kinds of garnet crystallize in the same system and are closely allied in all their properties, so that it is always an easy matter to distinguish garnet of any variety from other minerals.

LOANED BY FOOTE MINERAL CO.

GARNET.

Almandite (Colorado.)
Essonite (Italy.)
Garnet in Matrix (Alaska.)

Garnet in Matrix, polished (Mexico.)

Almandite (Connecticut.)
Garnet (Hungary.)
Uvarovite in Matrix (Canada.)

BERYL.

Golden Beryl (Siberia).

Blue Beryl (Siberia).

Blue Beryl (Albany, Maine).
Aquamarine (Conn.)
Golden Beryl (Conn.)

COPYRIGHT 1901, BY A. W. MUMFORD, CHICAGO.

Aquamarine (Ural Mountains).

Emerald in the Matrix (Ural Mountains).

BERYL

This mineral species includes a number of varieties which are highly valued as gems. These are, besides Beryl itself, the gems emerald, aquamarine, and golden beryl. Chrysoberyl, it may be noted, is not a variety of beryl, but a distinct species.

While these gems all differ in color, they are the same mineral and are practically identical in composition, hardness, and other properties. In composition they are a silicate of aluminum and glucinum, the percentage being, for normal beryl, 67 per cent. of silica, 19 per cent. of alumina, and 14 per cent. of glucina.

The beautiful green color of the emerald is probably due to a small quantity of chromium which it usually contains, though some authorities believe organic matter to be the coloring ingredient. To what substance the other varieties of the species owe their color is not known.

In hardness the varieties of beryl differ little from quartz, the hardness being 7.5 to 8 in the scale of which quartz is 7. They are somewhat inferior, therefore, to such gems as topaz, sapphire, and ruby in wearing qualities, although hard enough for ordinary purposes.

The specific gravity of beryl is also about like that of quartz, ranging from 2.63 to 2.80, the specific gravity of quartz being 2.65. The varieties of beryl are, therefore, relatively light as compared with other gems.

Beryl crystallizes in the hexagonal system. It usually occurs as six-sided prisms, commonly terminated by a

single flat plane, but sometimes by numerous small planes, giving a rounded effect. Occasionally it terminates in pyramidal planes which cause the prism to taper to a sharp point.

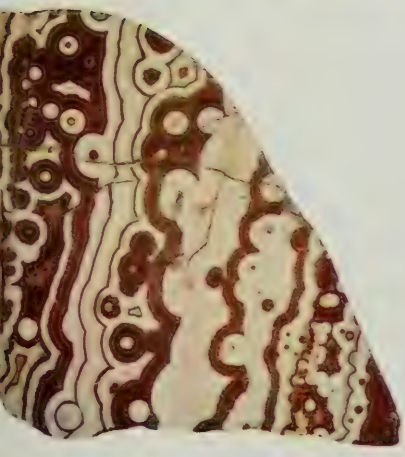
The crystals sometimes grow to enormous size, exceeding those of any other known mineral.

Ordinary beryl is a mineral of comparatively common occurrence, being often found in granitic and metamorphic rocks.

AGATE

Agate is a form of the common mineral quartz. From other forms of that mineral it differs in being made up of minute layers and in being variegated in color. The colors may appear in the form of bands or clouds. The banded agates appear to be made up of parallel layers, sometimes straight, but more often wavy or curved in outline. These layers or bands differ in color from one another, exhibiting shades of white, gray, blue, yellow, red, brown, or black. To the naked eye they appear to vary in width from the finest lines to a width of a quarter of an inch or more. In reality, all the bands visible to the naked eye are made up of finer ones, to be seen only with the microscope. Thus, in a single inch of thickness of agate Sir David Brewster, using the microscope, counted seventeen thousand and fifty layers. Besides differing in color, the layers differ in transparency and porosity, and these properties add to the variegated appearance of the agate.

On account of their beauties of color and outline, agates have been known and prized from the earliest times. They



AGATE.

COPYRIGHT 1901, BY A. W. MUMFORD, CHICAGO.

Banded Agate (Brazil).

Banded Agate (Lake Superior).
Moss Agate.

Clouded Agate.

TOURMALINE.

Green Tourmaline (Brazil).
Green Tourmaline (Haddam, Conn.)
Cross Section of Green Tourmaline (Cal.)

Red Tourmaline or Rubellite (Island of Elba).
Brown Tourmaline (Gouverneur, N. Y.)
Red Tourmaline or Rubellite, in Lepidolite (Cal.)

Black Tourmaline (Finland).

COPYRIGHT 1903, BY A. W. MUMFORD, CHICAGO.

are mentioned by many of the ancient Greek writers, and the name agate is a corruption of the name Achates, a river in Sicily, whence the first stones of this kind used by the Greeks were obtained. This and neighboring localities continued to be the source of supply until the fifteenth century, when agates were found to occur in large quantities near Oberstein and Idar, on the banks of the river Nahe, in the duchy of Oldenburg.

The industry of cutting and polishing the agates on a large scale was soon established there, and these places are to this day the center of the agate industry. The agates used most extensively at the present time are not, however, those found about Oberstein, but come from a region about one hundred miles in length extending from the province of Rio Grande do Sul, of southern Brazil, into northern Uruguay.

TOURMALINE

Early in the eighteenth century some children of Holland, playing, on a warm summer's day, in a courtyard with a few bright-colored stones, noticed that these possessed a strange power when warmed by the heat of the sun. They attracted and held (just as a magnet attracts iron) ashes, straws, and bits of paper. On reporting this strange discovery to their parents, the latter, it is said, could give no explanation of the curious property, but a relic of their knowledge of it is left in the name of "aschentreckers," or "ash-drawers," which they gave the stones and by which they were known for a long time.

Such was the method of introduction to the civilized

world of the mineral now known as Tourmaline, a mineral which in variety of color, composition, and properties is one of the most interesting in nature.

The lapidaries who had given the Dutch children the stones for playthings did not recognize them as different from the other gems in which they were accustomed to deal. So to the present day, although tourmaline is considerably used in jewelry, it is rarely ever called by that name. The green varieties are often known as Brazilian emerald, chrysolite, or peridot, some varieties of blue as Brazilian sapphire, others as indicolite, the colorless as achroite, and the red as rubellite, siberite, and even as ruby.

It is only somewhat recently that these different stones have been recognized as being varieties of a single mineral species which is known by the name tourmaline. This name comes from a Cingalese word (Turamali) which was applied to the first tourmaline gems sent from Ceylon to Holland.

In its opaque form, colored either black or brown, tourmaline is a comparatively common mineral. It accompanies many so-called metamorphic rocks, *i.e.*, rocks which have been changed by heat and pressure from their original condition, and is also common in granite and other eruptive rocks.

OBSCURELY CRYSTALLINE QUARTZ

The best Carnelians come from India, but good stones are also obtained in Siberia, Brazil, and Queensland. Carnelians are cut usually in oval and shield-like shapes and were much employed by the ancients for intaglios. They

469

QUARTZ (obscurely crystalline).

COPYRIGHT 1902, BY A. W. MUMFORD, CHICAGO

Bloodstone polished (India).
Tiger Eye, polished (South Africa).

Chrysoprase (Silesia).
Agate and Carnelian, polished (Lake Superior).

Jasper (Germany).
Ribbon Jasper, polished (Siberia).

believed them to have the power of preventing misfortune and they were much worn as charms.

Sard of typical brown color is much rarer than carnelian and possesses a high value. In other respects it is like carnelian.

Chrysoprase and Prase are terms applied to an apple-green to bright green chalcedony or compact, jasper-like form of quartz.

Plasma is a name applied to green chalcedony, or by some to green jasper.

Bloodstone is a variety of plasma containing spots of red jasper looking like drops of blood. Another name for bloodstone, by which it was chiefly known by the ancients, is heliotrope.

Onyx and Sardonyx are varieties of agate in which the layers are in even planes of uniform thickness. This structure permits of the stone being used for engraving cameos.

The sardonyx was supposed by the ancients to be a different stone from the onyx. To it was ascribed the property of conferring eloquence upon its wearer.

Jasper is a name which includes in general nearly all varieties of impure, opaque colored crypto-crystalline quartz. In color it may be red, yellow, green, brown, bluish, and black.

Basanite is also known as Lydian stone or touchstone, on account of its use for trying the purity of metals. Its value for this purpose depends on its hardness, peculiar grain, and black color.

Flint is likewise an opaque quartz of dull color. It

differs from jasper in breaking with a deeply conchoidal fracture and a sharp cutting edge.

LAPIS LAZULI, AMBER AND MALACHITE

The stone known as Lapis Lazuli as it occurs in nature is not a single mineral, but a mixture of several, among which are calcite, pyrite, and pyroxene. From these, however, it is possible to separate a mineral of uniform composition sometimes crystallized in dodecahedrons which is probably the essential ingredient of the stone. This mineral is known as Lazulite and in composition is a silicate of soda and alumina with a small quantity of sodium sulphide.

Amber is a fossil gum of trees of the genus Pinus, and is thus a vegetable rather than mineral product. In color it is yellow varying to reddish, brownish, and whitish. Its hardness is 2 to 2.5, it being slightly harder than gypsum and softer than calcite. It cannot be scratched by the finger nail, but easily and deeply with a knife. It is also brittle.

The specific gravity of amber is scarcely greater than that of water, the exact specific weight being 1.050-1.096. It thus almost floats in water, especially sea water. It is transparent to translucent.

Malachite is a green opaque mineral whose color indicates a salt of copper. It is a carbonate of copper containing water, the percentages being in the typical mineral, cupric oxide 71.9, carbon dioxide 19.9, and water 8.2. It is the common form which copper assumes when it or even

AMBER, MALACHITE, LAPIS-LAZULI AND AZURITE.

COPYRIGHT 1902, BY A. W. MUMFORD, CHICAGO.

Lapis-lazuli, polished (Siberia).

Amber, polished, showing insects enclosed (Coast of Baltic Sea).

Malachite and Azurite, polished (Arizona).

Malachite, polished (Australia).

Amber, rolled pebble (Coast of Baltic Sea).

Malachite, polished (Ural Mountains).

Malachite (Arizona).

LOANED BY FOOTE MINERAL CO.

FELDSPAR.

COPYRIGHT 1902, BY A. W. MUMFORD, CHICAGO.

Amazonstone, crystallized (Colorado).
Labradorite, polished (Labrador).
Sunstone (Norway).

Amazonstone, crystallized (Colorado).

Amazonstone (Colorado).
Labradorite, polished (Labrador).
Moonstone, polished (Norway).

its ores oxidize in the air. Many of the green stains on rocks or minerals can be correctly referred to malachite. It is only valued for ornamental purposes, however, when it occurs in compact masses, usually exhibiting concentric layers. Malachite in this form takes a fine polish. Malachite is not a hard mineral, its hardness being between 3.5 and 4.

FELDSPAR

Feldspar is the family name of several minerals closely related, and, indeed, grading into each other, but distinguished by mineralogists by separate specific terms. These minerals are all silicates of aluminum, with some alkali or alkali earth, having a hardness of about 6 in the scale in which quartz is 7.

As ornamental stones only certain varieties of feldspar are valued and their value depends on accidents of color or structure. The first of the feldspars which may be mentioned as being prized as an ornamental stone is amazonstone or green feldspar.

It is only to the green variety that the name of amazonstone is applied, a name meaning stone from the Amazon River.

The second species of feldspar which may be mentioned as of use as an ornamental stone is labradorite. This differs in composition from amazonstone in containing soda and lime in place of potash.

The gems known as moonstone and sunstone owe the play of colors which gives them their respective names to similar causes. These gems are generally some form of

feldspar, although any mineral giving a similar sheen of color might be included under them.

The Ceylon moonstone is sometimes known as Ceylon opal, but it is the variety of feldspar known as orthoclase, which is a potash feldspar.

Sunstone is the term by which those kinds of feldspar are known which reflect a spangled yellow light.

Both sunstones and moonstones can be accurately imitated in glass and the distinction of the artificial from the real by ocular examination alone would be almost impossible.

Gems are occasionally cut from other forms of feldspar than those here described, which are transparent and colorless and valued for their luster.

ORNAMENTAL STONES

Rhodonite.—Rhodonite is a silicate of manganese, of a pink or flesh-red color. It does not furnish transparent gems, but, occurring massive in large pieces, affords material for table-tops, vases, jewel-boxes, paper-weights, and other large objects in which such a color is desired. The stone has a slight translucency, which heightens its effect when polished, and it is also like jade in being quite tough.

Thulite.—Another rose-red massive stone is furnished by the variety of zoisite, known as Thulite. This resembles rhodonite in color somewhat, but is easily distinguished by its chemical characters, zoisite being a hydrous silicate of calcium and aluminum. It is somewhat harder than rhodonite.

SPECIMENS LOANED BY F. J. ESSIG.

COPYRIGHT 1903, BY A. W. MUMFORD, CHICAGO.
AMERICAN COLORTYPE CO., CHI. & N. Y.

ORNAMENTAL STONES.

Satin Spar, polished (Italy).
Thulite, polished (Norway).
Serpentine, polished (Cornwall, England).

Smithsonite, polished (Greece).
Serpentine, polished (Cornwall, England).
Serpentine, rough (Cornwall, England).

TOPAZ

COPYRIGHT 1901, BY A. W. MUMFORD, CHI.

Topaz with Mica and Feldspar (Russia).. Topaz (Brazil).

Topaz in Rhyolite (Utah).

Topaz (Japan). Waterworn Topaz (Brazil).

Precious Serpentine. — This mineral resembles jade in appearance and properties and is suited to many of the ornamental uses to which the former is put. Not a little so-called jade is doubtless serpentine. The hardness of serpentine is somewhat below that of jade.

Alabaster. — The term alabaster is derived from a kind of ointment vases called alabastra which the Egyptians and peoples of a later period were accustomed to carve out of stone. This stone was largely a stalagmitic calcite obtained at Thebes, but it is probable that gypsum was also used to some extent. At the present time the term is used loosely for either of these minerals when employed for the manufacture of ornamental objects, although stalagmitic calcite is now more generally designated as onyx.

Smithsonite. — Smithsonite is a carbonate of zinc mined extensively as an ore of that metal and sometimes possessing sufficient translucency and beauty of color to make it prized as an ornamental stone.

TOPAZ

Remarkable clearness and transparency, capacity of taking a high polish, and hardness and weight greater than that of quartz. These are the qualities in which Topaz excels as a gem. True topaz is a silicate of alumina, containing hydroxyl and fluorine. Its hardness is 8 in the scale in which quartz is 7. Hence, it will scratch the latter mineral and may thus be distinguished from it. It is also remarkably heavy, considering its composition, it being

three and one-half times as heavy as water, while quartz is only two and one-half times as heavy.

The color typically associated with topaz in its use as a gem is yellow, yet the mineral species exhibits many other shades of color, which, when present in crystals of sufficient clearness and purity, answer equally well for gem purposes. These other shades, most of which are represented in the accompanying plate, are grayish, greenish, bluish, and reddish. Topaz may also be quite colorless. The yellow color of the Brazilian topaz can be changed by heating to a pale rose pink and the gem is often treated in this way. The degree of heat employed is not high, and both heating and cooling must be performed gradually. Warming in a sand bath at a low red heat is the method usually employed, or the stone may be wrapped in German tinder and the latter set on fire. Only stones of a brown-yellow color yield the pink; the pale yellow stones turn white when so treated. Once the pink color is obtained it is permanent.

The natural colors of topaz are, in general, perfectly durable, although some of the deep wine-yellow topazes from Russia fade on exposure to daylight.

Topaz is infusible before the blowpipe. It is not affected by hydrochloric acid, but is partially decomposed by sulphuric acid and then yields hydrofluoric acid.

The crystals of topaz belong to the orthorhombic system of crystallization. They are usually elongated in the direction of the prism and have sharp, bright faces. They vary much in size and often are large. One crystal weighing twenty-five pounds was found in Siberia.

QUARTZ (crystalline).

COPYRIGHT 1902, BY A. W. MUMFORD, CHICAGO

Rutilated Quartz, polished (Brazil).
Rose Quartz, polished (Black Hills).

Smoky Quartz (Switzerland).

Amethyst (Virginia).
Amethyst (Montana).

CRYSTALLINE QUARTZ

This is the most abundant, most durable, and most indestructible of common minerals. There is scarcely a sand beach, field, or mountain-side upon which this mineral cannot be found in some form or other. Its abundance is due not so much to its excess in quantity in the underlying rocks as to the fact that, being harder and less easily decomposed than other minerals, it remains after they are worn away.

Though so common, it appears in so great a variety of colors and different kinds of structure that a large collection of minerals looking very much alike might all be made up of Quartz. If they were all of quartz they would have the following characteristics: Hardness, 7 (cannot be scratched with a knife blade); specific gravity, two and a half times as heavy as water; no cleavage; fracture conchoidal (shell-like); infusible before the blowpipe; insoluble in common acids. The numerous varieties of quartz can be grouped into two classes, the pheno-crystalline (plainly crystalline) and the crypto-crystalline (obscurely crystalline).

This article deals only with the plainly crystalline varieties. These include, among other varieties, rock crystal, amethyst, rose quartz, smoky quartz, and sagenitic quartz. These varieties all occur in well-formed crystals, and all have a vitreous luster, *i.e.*, luster like that of glass. The differences between them are almost exclusively differences of color.

Rock Crystal. — This is quartz in its purest form. Typical rock crystal is perfectly transparent and colorless, but the mineral is often more or less clouded and opaque.

Amethyst. — This is the name given to the violet or purple varieties of crystallized quartz.

Rose Quartz. — This form of quartz, the color of which is indicated by its name, is rarely of sufficient transparency to be prized as a gem.

Smoky Quartz. — This variety of quartz is often known as "smoky topaz," a misleading term, since the mineral is not topaz at all.

Sagenitic Quartz. — This form of quartz, also known as "saganite," "fleche d'amour" (love's arrow), "Venus' hair stone," and, if the included mineral be rutile, "rutilated quartz," is rock crystal containing inclusions of other minerals in hair-like or thread-like forms.

Plants

CHAPTER I

FLOWERS

Flowers are the essential parts of higher plants, as they are necessary to fruit and seed formation. Some flowers are beautiful and fragrant, while others are neither; some are large and showy, but emit a disagreeable odor. The part of the flower which attracts the eye is usually the corolla, formed of the separate or united petals, which vary in size, form, and color. Somewhere near the base of the corolla are found the nectaries or glands which secrete the nectar so highly appreciated by insects and from which nectar the bee makes its honey.

Flowers of different species of plants open or develop at different periods of the season of active growth. Some open early in spring, while others do not develop until late in the fall.

Double flowers (culture products of gardens, etc.) are generally considered more handsome than the wild, unchanged, or normal flowers. Albert Schneider.

FLOWERS AND THEIR INVITED GUESTS

When flowers first appeared, it became necessary to secure the transfer of the pollen-grains to the stigmas. This was necessary in order that the ovule might be developed into a seed containing a young plant or embryo. At

first the currents of air were selected as the agents of this pollen transfer, and the flowers were adapted to what is known as wind-pollination. As the wind is an inanimate agent, and any transfer by it is largely a matter of chance, in order to increase the chances of successful pollination, it was necessary for pollen to be developed in enormous quantities, so that it might fall like rain. In this way stigmas would be reached, but at the same time an enormous amount of pollen would be wasted. The evergreens are good illustrations of wind-pollinated plants, and their showers of pollen are very familiar to those who live near pine forests. When these showers come down in unaccustomed regions, they are often spoken of as "showers of sulphur," and the local newspapers are full of accounts of the mysterious substance.

In wind-pollinated plants not only must the pollen be excessively abundant, but it must also be very light and dry. Sometimes the buoyancy is increased by the development of wings on the pollen grains, as in the case of pines. This habit of pollination is found not only among the evergreens, but also among many important families of higher plants, as in the ordinary forest trees, the grasses, etc.

When the higher forms appeared, however, flowers of a different character gave evidence that a new type of pollination was being devised. Instead of the old wasteful method, insects were called in to act as agents of the transfer. By securing an animate agent, there is a definiteness in the pollination and a saving in pollen production which is quite in contrast with the wind method. It must not be supposed that all flowers have learned to use insects with

LADY'S SLIPPER.
(Cypripedium hirsutum.)

COPYRIGHT 1900, BY A. W. MUMFORD, CHICAGO

equal skill, for many of them may be said to be clumsy in their arrangement. On the other hand, certain families have reached a high degree of organization in this regard, and arrange for insect visits with a skill and completeness of organization which is astonishing.

In order to secure visits from insects, so that pollination may be effected, flowers have been compelled to do several things. In the first place, they must provide an attractive food. This has taken two prominent forms, namely, nectar and pollen. There are insects, such as butterflies, which are not only attracted by the nectar, but whose mouth parts have only been adapted for sucking up a liquid. There are other insects, however, like the bees, wasps, etc., which are able to take the more substantial pollen as food. Accordingly, insects which visit flowers may be roughly divided into the two classes, nectar-feeders and pollen-feeders.

In the second place, the flower must notify the insect in some way that the food is present. This is done primarily by the odors which the flowers give off. It must not be supposed that odors which are sensible to us are the only ones sensible to insects, for in general their sense of smell is far keener than ours. It is also probably true that the display of color, which is so conspicuously associated with flowers, is an attraction to insects, although this has become somewhat doubtful lately by the discovery that certain insects which were thought to be attracted by color have proved to be color-blind. At present, however, we have no reason to suppose that color is not associated in some prominent way with the visits of insects.

It should be noticed, also, that two kinds of pollination

are possible. The pollen may be transferred to the stigma of its own flower, or it may be carried to the stigma of some other flower, and this other flower may be some distance away. The former method may be called self-pollination; the latter, cross-pollination. It seems evident that flowers in general have made every effort to secure cross-pollination. JOHN MERLE COULTER.

A PATTERN FLOWER

Flowers are of very many patterns, and it must not be supposed that there is any special pattern for them all. There are four parts which belong to flowers in general, and they are repeated in various flowers in numberless ways, or one or more of the parts may be omitted.

The flower of the common wild lily, chosen for our illustration, is highly organized, with all the parts represented and well developed. Each part is constructed for some definite work, which we may or may not fully understand.

The flower of the illustration shows on the outside six leaf-like bodies, colored a deep orange or reddish, and bearing dark spots. These six bodies are in two sets of three — an outer and an inner set. When there are two sets of these leaf-like bodies, the outer set is called the *calyx,* and the inner one the *corolla.* The three leaves of the calyx are called *sepals,* and the three leaves of the corolla, *petals.*

In this case, the sepals and the petals look alike, and then it is usual to speak of the whole set of six as the perianth. In many flowers, however, the sepals and petals

RED OR WOOD LILY.
(Lilium Philadelphicum).

FROM "NATURE'S GARDEN"
COPYRIGHT 1900, BY
DOUBLEDAY, PAGE & COMPANY

do not look at all alike. In the common wake-robin, or *Trillium,* a near relative of the lily, the three sepals are like ordinary small green leaves, while the petals are much larger and showy, giving the characteristic color to the flower.

In the lily, it should be further noticed that the sepals and petals are all separate, but in many flowers they are united in various ways to form urns, tubes, funnels, trumpets, etc. The common morning glory is an illustration of a flower in which the petals are united so as to form a beautiful trumpet-shaped or funnel-form corolla.

The general purpose of the perianth — that is, the two outer parts of the flower — is to protect the far more important inner parts in the bud, and when the flower opens the perianth unfolds and exposes the inner parts, which are then ready for their peculiar work.

The bright color usually shown by the corolla, and sometimes also by the calyx, as in the lily, is probably associated with the visits of insects, which come to the flower for nectar or other food. Since it has been found, however, that some visiting insects are color-blind, it is doubtful whether the color is so universal an attraction as it was once thought to be, but it is certainly associated with some sort of important work.

A summary of these various duties is as follows: The green, leaf-like calyx is certainly for bud protection; the brightly colored corolla (and sometimes calyx) adds to the duty of protection that of attracting necessary insects, or some other duty that we do not as yet understand.

Just within the corolla, the third part or set appears,

consisting of six *stamens.* These six stamens are also in two sets of three each, an outer and an inner one. Each stamen consists of a long, stalk-like part, called the *filament,* and at the summit of the filament is borne the *anther,* which in the lily consists of two long, narrow pouches lying side by side. When the anther is ripe, these pouches are filled with a yellow, powdery dust, called the *pollen.* Each particle of this dust-like pollen consists of a minute but beautifully organized globular body, known as the *pollen-grain.* The anther pouches are, therefore, full of pollen-grains.

In the lily it will be noticed that when the anthers are ripe and the pollen is ready to be shed, a slit opens lengthwise in each of the two pouches or sacs. This is the common method for opening the anther sacs, but in some flowers it is curiously modified. For example, in the heaths, such as the huckleberry, the sacs open by a hole at one end, and sometimes the tips of the sacs are drawn out into long, hollow tubes through which the pollen is discharged. In other cases, as in the sassafras, the sacs open by little trap doors, which swing open as if upon hinges.

Of the two parts of the stamen, the filament and the anther, the latter is the essential one, so that in some cases the filament may be lacking entirely, only the anther appearing to represent the stamen. Furthermore, the essential thing about the anther is the pollen, to manufacture which is the sole purpose of the stamen.

The pollen is necessary to enable the flower to produce seeds, but it must be transferred from the anther which produces it to the fourth part of the flower, not yet

LILY OF THE VALLEY.
Life-size.

COPYRIGHT 1896, BY A. A. MUMFORD, CHICAGO

described, in which the seeds are formed. This transfer of pollen is known as *pollination,* and the transfer is usually effected in one of two ways — by the wind or by insects.

The fourth or innermost part of the lily flower is an organ called the *pistil.* It stands in the center of the flower, and is composed of three distinct regions. At the base it is bulbous and hollow, containing the bodies which are to become seeds. This bulbous region is called the *ovary,* and the little bodies it contains, which, through the action of the pollen, are to become seeds, are called *ovules.* Rising from the top of the ovary is a slender, stalk-like part called the *style;* and at the top of the style is a knob-like region called the *stigma.*

The most essential region of the pistil is the ovary, for it contains the ovules. Next in importance is the stigma, for it must receive the pollen-grains. The style is of least importance, and therefore is sometimes wanting, the stigma being directly upon the ovary. The duty of the style, when it is present, seems to be to put the stigma into a favorable position to receive the pollen. JOHN M. COULTER.

THE LILY OF THE VALLEY

The Lily of the Valley is one of the most delicate and beautiful of the lily family. With the exception of the orchid family, probably no group of plants furnishes a larger variety of popular forms noted alike for their beauty and delicacy.

It has been truly said of the lily family that "the flowers of most are beautiful, of many brilliant, and some truly

splendid." This family contains about one hundred and fifty genera and over thirteen hundred species. They are world-wide in their distribution, excepting the Arctic zone, though they are more common in the temperate and subtropical regions.

Among the species sought by the lover of cultivated flowers, none is more noteworthy than the tulip, a native of Persia. It is claimed that there are more than seven hundred forms of the tulip known to the florist—all variations of a single species.

The type of the family is the lily. The lily is the Persian personification of night, *lil* or *lilleh* being essentially the words used to designate evening.

To this family also belong the day-lily, the tuberose, the hyacinth, the yucca, and the star-of-Bethlehem. Here also is classed the useful though much-abused onion, the flowers of which, though small, form a most graceful group at the top of the stem, especially in the wild species.

The lily of the valley is a native of the mountainous regions of Virginia and southward through Georgia. It is identical with the cultivated form, which was brought from Europe.

The pure white of the flowers, as well as their symmetrical form, has led writers to speak of them as the symbol of purity, and no flower, perhaps, is in greater demand for the decoration of the church and home.

W. K. Higley.

584

COMMON CALLA LILY.
(Richardia africana).
About ⅓ Life-size.

COPYRIGHT 1903, BY A. W. MUMFORD, CHICAGO

CALLA LILY

The so-called Calla Lily is an herbaceous plant belonging to the *Araceæ,* and is closely related to calamus, Jack-in-the-pulpit, and arum. It is a native of South Africa, and, like most of the order, it prefers a very moist soil and warm climate. It has comparatively large sagitate leaves; is monœcious, the staminate and pistillate flowers being in close proximity on the same plant.

The plant is also known as Lily of the Nile, African Lily, and Ethiopian Lily. The word Calla is supposed to be derived from calyx, the first protective covering of complete flowers. The plant is very extensively cultivated in all countries, especially the warmer countries and islands. It is to be found in gardens, hothouses, and conservatories. The plant has evidently been known for many centuries.

Some very misleading opinions and names exist with reference to this plant. In the first place, it is not a lily at all, belonging to an entirely different order. The Lily of the Nile is wrong, because it is a native of South Africa. To speak of the handsome flowers is wrong, because the part mostly admired is not a flower in the botanical sense, but simply a leafy involucral covering of a pure waxy-white color. The inflorescence proper is the yellow central cone-like structure known as spadix, and upon which the small, non-attractive staminate or pistillate flowers are closely crowded. Calla, according to the etymology of the word, is wrong, for reasons already given — that is, it is not a true calyx, but rather a calyx or corolla-like involucre.

It no doubt serves the function of a corolla in that it attracts insects for the purpose of effecting pollination.

A. SCHNEIDER.

THE EASTER LILY

The Easter Lily is the symbol of a ceremonial which is older than history. It illustrates a story as old as humanity—one which tells of feasts to the Great Spirit in gratitude for the return of spring or for a bountiful harvest. Unlike other primitive observances which have become obsolete, or more recent forms of thanksgiving which have no relation to the past, the Easter festival has been handed down through the ages, replete with religious significance to almost every race of mankind.

In 1875 a beautiful form of the lily family was brought by a woman to Philadelphia, from Bermuda. This lily (*Lilium longiflorum*) at once obtained great popularity by reason of its unusual size, the large number of flowers on each stem, and their extraordinary beauty and purity. The imported plants were soon bought by Mr. W. K. Harris, of Philadelphia, who named it the *Lilium harrisii,* but at the present time it is known as the *Lilium longiflorum,* variety eximum.

The great beauty of the flowers, the fact that the plants mature early in the sason, and their ability to endure a high temperature, allowing them to be forced to bloom during the winter, all combined to make this lily the universal choice for the typical Easter flower, which position it still worthily maintains, as though conscious of the deep

567

EASTER LILY.

$\frac{3}{4}$ Life-size.

COPYRIGHT 1903, BY A. W. MUMFORD, CHICAGO

348

WILD YELLOW OR CANADIAN LILY.
(Lilium Canadense).

"FROM NATURE'S GARDEN"
COPYRIGHT 1900, BY
DOUBLEDAY, PAGE & COMPANY

significance of the festival of which it is the chosen floral emblem. C. S. Raddin.

THE WILD YELLOW LILY*

Among our common wild flowers that quickly attract the attention of the observer is the Yellow Lily. Its home is in the swamps, the wet meadows and fields of Canada and the United States, east of the Missouri River. It is also called the Canada, the Field, and the Meadow Lily.

This plant, with about forty-five sister species, all beautiful, belongs to the genus Lilium. All are natives of the Northern Hemisphere and are found distributed around the world. About sixteen species are natives of the United States. The flowers vary in color. Some are red, others white or yellow, and some are more or less mottled.

No plants are more frequently mentioned in ancient myths and by the classical poets.

The slender stalk of the yellow lily arises from a scaly, bulbous, and thickened underground stem, growing to a height of from two to five feet. The leaves are narrow and lance-shaped, from two to six inches in length, and usually attached in whorls of from three to eight. Each stalk bears from one to fifteen flowers, the ground color of which is yellow or reddish with brownish spots toward the base of each division, which are six in number and are spreading and gracefully arched. The flowers, appearing in June, July, and August, are nodding, and vary in length from two to four inches. The fruit pods are oblong, large, and bear numerous seeds.

Closely related to the plant of our illustration, and at times closely resembling it, is the beautiful Turk's Cap Lily (*Lilium superbum*). This species is wonderfully prolific in the production of flowers, sometimes bearing forty or more on a single stalk. It is one of the tallest of the lilies, and frequently the marshes of the Eastern States are transformed by its presence into striking masses of color, orange, orange-yellow, or red.

THE ROSE

There are a number of rose species. All are shrubby and vary from small erect to very tall climbing or twining plants. In the wild state the flower is generally single, its petals (five in number) forming one circle. Numerous yellow stamens and pistils; woody stem, branching, with numerous prickles; leaves alternate, stalked with elongated pointed stipules and from three to seven oval, oblong, serrate leaflets; flowers showy, variable in color; fruit (hip) quite large, red color, bearing numerous hairy, hard seeds.

The rose has been in cultivation for many centuries.

Rose water was first prepared on a large scale in Persia. Not only was rose water used as a cosmetic and a medicine, but it was also used in cooking.

Rose oil, obtained from the petals, was not known until about 1570.

The great multitude of cultivated roses are all derived from a few species of wild growing ancestors.

Varieties are perpetuated by grafting buds or branches on a hardy stock, as the common dog rose. It is best to

LIBERTY ROSES.

COPYRIGHT 1900, BY A. W. MUMFORD, CHICAGO

COPYRIGHT 1902, BY A. W. MUMFORD, CHICAGO

CARNATIONS.
(Dianthus caryophyllus).

(Opp. 485)

graft on stocks native in the country in which it is desired to grow the variety. For example, in the United States any one of the wild growing species may be used as a stock plant.

The rose is a national emblem flower of England. It is quite universally recognized as the handsomest of all flowers. The rose signifies love, joy, and prosperity.

The principal use of the rose is for ornamental culture purpose. The famous rose oil (otto of rose) is used as a perfume. It is also employed for scenting snuff, hair oils, salves, and essences. Rose water is extensively used as an addition to gargles, eye washes, skin lotions, etc. The bright red hip is sometimes eaten and also used for decorative purposes. Country school children are in the habit of eating the petals and hips. The hips of the dog rose are used for making a confection. The petals are added to sachet powders. A. SCHNEIDER.

THE CARNATION

The Carnation is a native of central and Southern Europe. Since its introduction into England it is said to have escaped cultivation and to have become fixed in several localties. In its cultivation three general classes have been established by English specialists. The selfs are planted whose flowers have a uniform color. The flakes possess a pure ground of white or yellow, flaked or striped with one color, the stripes running longitudinally through the petals. The bizarres are such as have a pure ground, marked as in the flakes, but with two or three colors; this

form possesses the most fragrance, especially when there is a frequent recurrence of the stripes. Lastly, there are the picotees, having a pure ground, each petal being bordered with a band of color. This last form includes many of the rarest varieties, and the yellow picotee is famous in several royal establishments.

It is a peculiar fact that rain will injure the colors of the more delicate varieties, and the florist must shield the opening flowers from direct sunlight if he would obtain the best results.

In the perfect flower, the pod and calyx should be long, the flower circular, not less than three inches in diameter, rising gradually towards the center, so as to form a sort of crown. The outer petals should be large and few in number, rising slightly above the calyx and spreading horizontally, the other petals being regularly disposed above them, nearly flat, diminishing in size towards the center. The ground should be a pure color and the petals wax-like.

The carnation is allied to the pink family, and consequently is related to the modest Indian pink, the Chinese pink, and the Sweet William. These lowly forms doubtless nourish a secret pride in their relationship to the illustrious head of the house, concerning which Shakespeare said, "The fairest flowers of the season are our carnations."

C. S. Raddin.

GOLDENROD

Goldenrod, the name of numerous plants whose showy heads of flowers, waving like golden wands, make bright and gay the sides of roads, hills, and gravelly banks in the

GOLDEN ROD.
4/5 Life-size.

COPYRIGHT 1900, BY A. W. MUMFORD, CHICAGO

autumn. Although the general appearance of the racemed or else corymbed heads, which bear the florets, is diverse, yet the flowers themselves differ only from the asters in the smaller heads of (except in one species) yellow flowers. The genus is mostly North American, there being about eighty species, all of which but three or four belong to this country. It grows in thickets and woods, and formerly was much used in medicine. Its principle is astringent and tonic; the leaves and flowers, however, were thought aperient.

It occurs in the northern regions of America, but under very dissimilar forms. Perhaps the most interesting species is the sweet goldenrod, with a slender stem two to three feet high, often reclined; the leaves linear-lanceolate, entire, shining, covered with pellucid dots, which secrete a delicious anisate oil; the flower heads in racemes spreading in a one-sided panicle, the flower rays rather large and conspicuous. It may be occasionally found in rich, shady woods. An essence distilled from the leaves has been used to relieve spasmodic pains.

One of the earliest indications of the approach of autumn is in the flowers of the white goldenrod, the only species which has white flowers. Next comes into yellow bloom the tall Canadian goldenrod, and, following this, the gigantic goldenrod, and the tall goldenrod, names singularly misapplied, as the altitude of both is not unusual. Afterward may be seen *Solidago arguta* and other species, until the lingering florets upon the downy goldenrod indicate the near approach of the cold. The goldenrods generally affect dry and sterile soils, though some are found in bogs and

moist places, and range from alpine heights to the very margin of the sea. A. C.

THE CINERARIA

The Compositæ, the family of plants to which the cinerarias belong, contains about seven hundred and sixty genera and over ten thousand species, embracing approximately one-tenth of all the flowering forms. This is the largest family of plants, and includes the goldenrod, the sunflower, the aster, the chrysanthemum, the thistle, the lettuce, the dandelion, and many others. The species are widely distributed, though more common in temperate or hot regions, the largest number being found in the Americas.

Though a family of herbs, there are a few shrubs and in the tropics a small number of trees. The cultivated forms are numerous, and some are among our most beautiful fall plants.

The flowers are collected together in heads, and sometimes are of two kinds (composite). Using the sunflower for an example, we find a disk of tubular flowers in the center and, growing around it, a row of strap-shaped flowers, while in the dandelion they are all strap-shaped, and in some other species all are tubular.

The cineraria is an excellent illustration of the composite form, which bears both kinds of flowers.

The cinerarias form a large genus of practically herbaceous plants, and are chiefly natives of southern Africa and southern and eastern Europe. The varieties vary

FROM NATURE BY CHICAGO C. LIGHTYEE CO.

CINERARIA.
Life-size.

COPYRIGHT 1900, BY A. W. MUMFORD, CHICAGO.

COPYRIGHT 1900, BY A. W. MUMFORD, CHICAGO

FLOWERING ALMOND.
Life-Size.

greatly from white to pinkish-purple and through various shades to a dark bluish-purple.

They are quite easily cultivated, but are house plants in temperate latitudes. They are peculiarly liable to attack of insects, plant-lice being especially an enemy.

The florists' varieties are chiefly produced from the species *Cineraria cruenta.* Beautiful hybrids have been developed from this and other species, and the flower certainly deserves the popularity it has attained through sterling merit.

WM. K. HIGLEY.

THE FLOWERING ALMOND

The Sweet, the Bitter, and the Flowering Almond are all of a kin, and in this kinship many include also the peach and the nectarine. The flowering almond or the dwarf almond is a shrub which early in the spring, in March or April, sends forth its fair, rosy blossoms before its leaves are sprouted. The shrub seldom exceeds three feet in height. The leaves are like those of the willow, only darker and of a more shining green. It is really a native of Calmuck Tartary, but now is used extensively in gardens, because it blooms so early and can easily be cultivated in any dry soil.

The almond tree figures in history, mythology, and poetry. In this connection it is interesting to note that Aaron's famous rod was the shoot of an almond tree. Virgil, in the Georgics, welcomes the almond, when covered with blossoms, as the sign of a fruitful season.

In ancient times, everything that was considered of any

importance to the Greeks had some connection with the siege of Troy. Demophon, returning from Troy, suffered the fate of many another Greek worthy. He was shipwrecked on the shores of Thrace. He was befriended by the king and received as a guest. While at the court he met the beautiful daughter of his host. Immediately he fell in love with the charming princess, gained her love in return, and made arrangements for the marriage. But Demophon was obliged to return home to settle up his affairs before he could take upon himself these new ties. So the youth sailed away, but never to return. The princess, faithful Phyllis, watched and waited, hoping in vain for the return of her promised lord. Her constancy was noted even by the gods, who, when she was gradually pining away, turned her into an almond tree. Since then this tree has been a sign of constancy and hope. EMILY C. THOMPSON.

THE LADY'S SLIPPER

This interesting plant belongs to that remarkable family of orchids (*Orchidaceæ*) which includes over four hundred genera and five thousand species. They are especially noted for the great variety of shapes and colors of their flowers, many of them resembling beetles and other insects, monkey, snake, and lizard heads, as well as helmets and slippers, the latter giving rise to the name of the plant in our illustration. The variety, singular beauty, and delicate odor, as well as the peculiar arrangement of the parts of the flower, make many of the species of great financial value. This is also enhanced by the extreme care required in their culti-

LADY'S SLIPPER.

COPYRIGHT 1900, BY A. W. MUMFORD, CHICAGO

HYACINTH.
Life-size.

COPYRIGHT 1900, BY A. W. MUMFORD, CHICAGO

HYACINTH.
Life-size.

COPYRIGHT 1900 BY A. W. MUMFORD, CHICAGO

vation, which must be accomplished in hothouses, for the majority of the more valuable forms are native only in the tropical forests. Many, too, are rarely found except as single individuals, widely separated.

There are many parasitic species, and in the tropics a larger number attach themselves by their long roots to trees, but do not obtain their nourishment from them, while those belonging to temperate regions usually grow on the ground.

In the last sixty years the cultivation of orchids has become a passion in Europe and, to a great extent, in America.

It is said that "Linnæus, in the middle of the last century, knew but a dozen exotic orchids." To-day over three thousand are known to English and American horticulturists.

Though admired by all, the orchids are especially interesting to the scientist, for in their peculiar flowers is found an unusual arrangement to bring about cross-fertilization, so necessary to the best development of plant life.

W. K. Higley.

HYACINTH

Hyacinth, also called Jacinth, is said to be "supreme amongst the flowers of spring." It was in cultivation before 1597, and is therefore not a new favorite. Gerard, at the above date, records the existence of six varieties. Rea, in 1676, mentions several single and double varieties as being then in English gardens, and Justice, in 1754, describes upwards of fifty single-flowered varieties, and nearly one

hundred double-flowered ones, as a selection of the best from the catalogues of two then celebrated Dutch growers. One of the Dutch sorts, called *La Reine de Femmes*, is said to have produced from thirty-four to thirty-eight flowers in a spike, and on its first appearance to have sold for fifty guilders a bulb. Others sold for even larger sums. Justice relates that he himself raised several very valuable double-flowered kinds from seeds, which many of the sorts he describes are noted for producing freely.

It is said that the original of the cultivated hyacinth (*Hyacinthus orientalis*) is by comparison an insignificant plant, bearing on a spike only a few small, narrow-lobed, wash-blue flowers. So great has been the improvement effected by the florists that the modern hyacinth would hardly be recognized as the descendant of the type above referred to, the spikes being long and dense, composed of a large number of flowers; the spikes not infrequently measure six or seven inches in length and from seven to nine inches in circumference, with the flowers closely set on from bottom to top. Of late years much improvement has been effected in the size of the individual flowers and the breadth of their recurving lobes, as well as in securing increased brilliancy and depth of color. The names of hyacinths are now almost legion, and of all colors — carmine red, dark blue, lilac-pink, bluish-white, indigo blue, silvery-pink, rose, yellow, snow white, azure blue.

C. C. Marble.

THE SCARLET PAINTED CUP

The Scarlet Painted Cup belongs to a large and interesting group of plants, known as the figwort family. This family includes about one hundred and sixty-five genera and over twenty-five hundred species. They are common all over the world, reaching from the equator into the regions of constant frosts. It is claimed by some authorities that fully one thirty-fifth of all the flowering plants of North America are classed in this family.

Besides the painted cup, there are classed in this group the mullein, the common toad-flax, the foxglove, the gerardias, and the calceolarias.

The scarlet painted cup of our illustration is a native of the eastern half of the United States and the southern portion of Canada. It prefers the soil of meadows and moist woods, and has been found growing abundantly at an elevation of from three to four thousand feet.

The flowers are dull yellow in color and are obscured by the rather large floral leaves or bracts, which are bright scarlet — rarely bright yellow — in color. These conspicuous leaves are broader toward the apex and usually about three-cleft. By the novice they are usually mistaken for the flower, which is hardly noticeable. The stem seldom exceeds a foot in height, and bears a number of leaves that are deeply cut in narrow segments. The bright color of this plant has given it many local common names, more or less descriptive. Prominent among these is the Indian paint brush.

W. K. Higley.

SUNFLOWERS AND DAISIES

The Sunflowers are mostly large, erect, perennial herbs, with the flowers characteristic of the order Compositæ. They are natives of tropical America, but have become widely distributed in cultivation, appreciated on account of their large yellow flowers. They not only thrive very luxuriantly under cultivation, but spread very quickly spontaneously. Every one is familiar with the sunflower as it appears in cultivation; hence no special description shall be given of it. It is kin to the iron weed, the dandelion, the goldenrods, the asters, and the daisies.

It would be impracticable to describe or mention all the species and varieties of sunflowers and their numerous relatives. *Helianthus annuus* is a commonly cultivated species. The seeds of this plant furnish a very useful oil; the flowers yield honey and a useful dye; the stalks, a textile fabric, and the leaves, fodder. The seeds of this and other species are also used as food, and as a surrogate for coffee. The carefully dried and prepared leaves have long been used as a substitute for tobacco in cigars. Poultry eat the seeds very greedily and thrive well upon them, due to the oil present. It is also maintained that a large number of sunflowers about a dwelling place will serve as a protection against malaria. An infusion of the stem is said to be anti-malarial.

The Daisies, of which the oxeye daisy is a well-known example, are garden and field favorites. As already indicated, they are kin to the sunflowers. The word daisy is

TALL OR GIANT SUNFLOWER.

(*Helianthus giganteus.*)

BLACK-EYED SUSAN OR OX-EYE DAISY.

(*Rudbeckia hirta.*)

COPYRIGHT 19[illegible] BY
A. W. MUMFORD CHICAGO

356

WILD COLUMBINE.
(Aquilegia Canadensis).

FROM "NATURE'S GARDEN"
COPYRIGHT 1900, BY
DOUBLEDAY, PAGE & COMPANY

a contraction of the old English words "dayes eye," that is, the eye of day, meaning the sun, as indicated in the verse from Chaucer. There are a great many flowers known as daisies, and again, a given one has a number of popular names. For instance, *Rudbeckia hirta* is variously designated yellow daisy, black-eyed Susan, nigger-head, golden Jerusalem, and oxeye daisy. ALBERT SCHNEIDER.

THE COLUMBINE

Botanically, the Columbine is called Aquilegia, from the Latin word *Aquila,* meaning an eagle, in reference to a fancied likeness of the spurs of its flowers to the talons of an eagle. It is one of the crowfoot family.

This pretty and herbaceous perennial is distributed over most of the north temperate zone and, if not altogether a child of the mountains, it may be sought in rocky or stony localities. One is surprised to find the graceful Columbine defying the storms, with its roots carefully fastened in the deep crevasses of the rocks of rugged mountains and protruding its nodding flowers above some steep ledge where human foot has never trod. To many a weary wayfarer this little hermit flower has brought joy and pleasure. Though attractive to the lover of flowers, it is not met with in folklore nearly as frequently as many other species of plants that are far less attractive.

The genus aquilegia includes about twenty species and an endless number of varieties, produced by the skill and intelligence of the gardener. The United States can claim the prettiest of all the species of this widely distributed

group. One species is the wild columbine of our illustration. It is common everywhere. Here it is found covering rocky hills, softening the harsh gray of the rocks with its delicate foliage; there it enlivens the woodland borders with its nodding and pretty scarlet flowers, which are lined with bright yellow.

Though it has been stated that the columbines prefer the rocky hillsides, it must not be supposed that they will not tolerate a home in the border of a garden flower bed. Like many other plants of a similar nature, they thrive under cultivation, where a sunny and sheltered position is more suitable. One of the most beautiful of the garden varieties, or hybrids, is the double-flowered Skinner's columbine.

The columbines have been called "the flowers for the masses." Once started in the garden, they will propagate for years, and, although perennial, they increase rapidly by self-sown seed. The young plants will acquire sufficient size and strength before the close of the growing season, to endure the trying winter weather. JAMES JENSEN.

THE ASTERS

The Aster, in some of its varied forms, is found in all countries, over two hundred and fifty species being known to botanists. Although the plant is cosmopolitan, it is essentially an American form, one hundred and fifty of the total known species belonging to North America. Of the balance, Russia claims twenty, Europe ten, and Canada sixty or seventy.

NEW ENGLAND ASTER.
(Aster Novae-Angliae).

LATE PURPLE ASTER.
(Aster patens).

FROM "NATURES GARDEN"
COPYRIGHT 1900 BY
DOUBLEDAY, PAGE & COMPANY

It seems as though Nature, after the first blush of spring, relaxed her efforts for a supreme endeavor towards the close of the floral season. Then she assumes her festal robes and the woodlands and fields become gorgeous with the purple of the asters, the gold of the sunflowers and goldenrod, with here and there the cardinal and blue of the lobelias.

Among all this symphony of color, no plant is more lavish of its charms than the New England Aster. Botanically considered, the asters belong to the *Compositæ,* a family of plants including from ten to twelve thousand species, and characterized by large numbers of flowers crowded together into single heads, each of which gives the impression of a single flower. What appear to be petals are known as ray flowers, and give the characteristic color, as the purple, blue, or white of the aster or the yellow of the sunflower. These rays consist of flowers whose petals have been joined together and spread out flat, the points of the petals usually appearing on the end of the ray. In the case of the asters, the ray flowers, which occur in a single row, are pistillate or have a pistil and no stamens, and hence are capable of producing seeds. The center or disk flowers are tubular, yellow in color and perfect, containing both stamens and pistils. The heads are surrounded by an involucre, having leaflike tips, and are variously massed or branched along the stems of the plant.

With few exceptions, the asters are perennial, coming up each year from the old underground portions and flowering in autumn. They vary in height from a few inches to eight feet or more, but in the case of the New England

Aster, the completed growth is generally from two to seven or eight feet. CHARLES S. RADDIN.

THE BLOOD-ROOT

The Blood-root belongs to the poppy family, which includes about twenty-five genera and over two hundred species. These, though widely distributed, are chiefly found in the temperate regions of the North. To this family also belong the valuable opium-producing plant, the Mexican or prickly poppy, the Dutchman's breeches, the bleeding-heart, and the beautiful mountain fringe. A large number of the species are cultivated for ornamental purposes. The poppy is also cultivated for the commercial value of the opium it produces. All the species produce a milky or colored juice. Hence, indeed, we may say that behind beauty there lurks a deadly foe, for the juice of nearly all the species has active narcotic properties. This property is a means of protection to the plant under consideration, for its acrid taste is distasteful to animals.

This interesting plant is a native of eastern North America. It blossoms in April or May. Usually but a single flower is borne by the naked stalk that rises from the underground stem to the height of about eight inches. The flowers are white, very rarely pinkish, about one and one-half of an inch in diameter. The number of petals varies from eight to twelve, and they fall very soon after expansion. The sepals disappear before the bud opens.

A single leaf is produced from each bud of the underground stem. It is wrapped around the flower-bud as the

BLOODROOT.
(Sanguinaria canadensis).

COPYRIGHT 1900, BY A. W. MUMFORD, CHICAGO

FROM MAYFLOWER. BY PER.

NARCISSUS.

CHICAGO:
A. W. MUMFORD, PUBLISHER.

latter rises from the soil, and does not develop to full size until after the period of blossoming is over. The necessary food material for the production of the flower was stored in the underground stem during the preceding season. Thus the green leaf is not needed early in the growth of the plant.

The adult leaf is kidney-shaped, smooth, and five to nine lobed. When fully grown they are often more than six inches in diameter. The leaf-stalk, which may be over one foot in length, and the radiating veins vary in color from yellowish to orange. Few leaves are more beautiful and graceful than these, both during their development and when fully mature. W. K. Higley.

THE NARCISSUS

The genus of plants called Narcissus, many of the species of which are highly esteemed by the floriculturist and lover of cultivated plants, belongs to the Amaryllis family.

This family includes about seventy genera and over eight hundred species that are mostly native in tropical or semi-tropical countries, though a few are found in temperate climates.

Many of the species are sought for ornamental purposes and, on account of their beauty and remarkable odor, they are more prized by many than are the species of the Lily family.

In this group is classed the American Aloe, valued not only for cultivation, but also by the Mexicans on account

of the sweet fluid which is yielded by its central bud. This liquid, after fermentation, forms an intoxicating liquor known as *pulque*. By distillation, this yields a liquid very similar to rum, called by the Mexicans *mescal*. The leaves furnish a strong fiber, known as vegetable silk, from which, since remote times, paper has been manufactured.

There are about twenty-five species, chiefly natives of southern Europe, but some of them, either natural or modified by the gardeners' art, are world-wide in cultivation.

Blossoming early in the season, they are frequently referred to as "harbingers of spring." The flowers are handsome, large, varying in color from yellow to white and sometimes marked with crimson. They are usually borne on a nearly naked stem. Some of the species are very fragrant. The leaves are elongated, nearly sword-shaped, and usually about a foot in length, rising from the bulbous underground stem.

Among the forms that are familiar are the daffodils, the jonquils, and the poet's narcissus. W. K. Higley.

THE GENISTA

The countries adjacent to the Mediterranean Sea and the Indian Ocean produce a profusion of forms noted alike for their beauty and economic value.

In this region, with about forty-five sister species, is found the plant of our illustration. Carried from its home, it is now a common decoration of the greenhouse and private conservatory. Its sisters are of economic value. Some are used for garden hedges, some to arrest the ever-drift-

COPYRIGHT 1900, BY
A. W. MUMFORD, CHICAGO.

AZALEA.

ing sands of the seashore, and some to furnish a tanning principle.

These plants belong to the pea or pulse family, which also includes the clovers, the peanut, the locusts, the vetches, the acacias, the bean, the lupine, the tamarind, logwood, and licorice.

It has been estimated that this family contains over four hundred and sixty genera and about seven thousand species. Here are grouped herbs, shrubs, vines, and trees, the fruit of which is a pod similar in structure to that of the bean, and usually with irregular flowers. In this family the beasts of the field, as well as man, find some of their most valuable foods, and nearly all the species are without harmful qualities.

The pure yellow flowers are grouped along the branches in terminal clusters. They are sweet-scented, showy, and frequently so numerous as to make the plant appear like a mass of yellow blooms.

The leaves are very small, consisting of three leaflets similar in form to those of the common clove. The surface of the leaves and of the young twigs is covered by fine and soft hairs, causing a hoary appearance.

The plant is a shrub varying in height from a few inches to that of a man. It bears numerous and crowded branches.

W. K. Higley.

THE AZALEA

The Azalea belongs to the tribe of Rhododendrons, and consists of upright shrubs with large, handsome, fragrant flowers, often cultivated in gardens. The genus comprises

more than a hundred species, most of them natives of China or North America, having profuse clusters of white, orange, purple, or variegated flowers, some of which have long been the pride of the gardens of Europe. The general characteristics of the genus are a five-parted calyx, a five-lobed funnel-form, slightly irregular corolla, five stamens, a five-celled pod, alternate, oblong, entire, and ciliated leaves, furnished with a glandular point. Most of the species differ from the rhododendrons in having thin, deciduous leaves. Some botanists unite the genus azalea to rhododendron. North America abounds in azaleas as well as in rhododendrons, and some of the species have long been cultivated, particularly *A. nudiflora* and *A. viscosa,* which have become the parents of many hybrids. Both species abound from Canada to the southern parts of the United States. *A. calendulcea,* a native of the South, is described as frequently clothing the mountains with a robe of living scarlet. All the American species are deciduous. In cultivation, the azaleas love the shade and a soil of sandy peat or loam. Works on horticulture give specific and elaborate direction for the cultivation of the various species.

C. C. Marble.

IRIS*

In botany, this is the generic name of a number of beautiful plants belonging to the natural order of *Iridaceæ.* The plants have a creeping rootstock, or else a flat tuber, equitant leaves, irregular flowers, and three stamens. They are represented equally in the temperate and hotter regions of the globe. The wild species of iris are generally called

IRIS.

COPYRIGHT, 1899, DOUBLEDAY & MC CLURE CO., NEW YORK

blue-flag, and the cultivated flower-de-luce, from the French *fleur de Louis,* it having been the device of Louis VII, of France. Our commonest blue-flag, *Iris versicolor,* is a widely distributed plant, its violet-blue flowers, as may be seen, upon stems one to three feet high, being conspicuous in wet places in early summer. The root of this possesses cathartic and diuretic properties, and is used by some medical practitioners. The slender blue-flag, found in similar localities near the Atlantic Coast, is smaller in all its parts. A yellowish or reddish-brown species, resembling the first-named in appearance, is found in Illinois and southward. There are three native species which grow only about six inches high and have blue flowers. They are found in Virginia and southward, and on the shores of the Great Lakes; these are sometimes seen as garden plants. The orris root of commerce is the product of *I. Florentina, I. pallida,* and *I. Germanica,* which grow wild in the South of Europe; the rhizomes are pared and dried, and exported from Triest and Leghorn, chiefly for the use of perfumers; they have the odor of violets. The garden species of iris are numerous, and by crossing have produced a great many known only by garden names. The dwarf iris, *I. pumila,* from three to six inches high, flowers very early and makes good edgings to borders; the common flower-de-luce of the gardens is *I. Germanica;* the elder-scented flower-de-luce is *I. sambucina.*

THE OSWEGO TEA*

The *Labiatæ,* or family of mints, consists of about one hundred and sixty genera, including the one to which the Oswego Tea of our illustration belongs. Under these genera are classed over three thousand distinct species. Many of these are well-known plants, such as the mints, pennyroyal, anise, bergamot, fennel, catnip, sage, thyme, lavender and rosemary. Representatives of this family are distributed throughout the world in the temperate and tropical regions. In fact, it is one of the most cosmopolitan of the plant families.

This genus includes about ten species, all natives of North America and Mexico.

The Oswego tea is frequently called Bee Balm, and locally it is often known as Fragrant Balm, Mountain Mint, and Indian Plume. This plant prefers a moist soil near the wooded banks of streams and in the hilly and mountainous regions of Canada and the United States, east of the Mississippi River. In North Carolina it is found at an altitude of about five thousand feet.

The leaves are egg-shaped, elongated, taper-pointed, and more or less saw-toothed on the margins. The floral leaves are tinged with red of nearly the same shade as that of the bright red and showy flowers. The flowers, which appear in July, August, and September, and are about two inches in length, are massed in a dense solitary and globular head, which is situated at the end of the flower stalk.

OSWEGO TEA OR BEE BALM.

(*Monarda didyma.*)

FROM "NATURE'S GARDEN"
COPYRIGHT 1900, BY
DOUBLEDAY, PAGE & COMPANY.

423 GREAT MULLEN OR VELVET DOCK
(Verbascum thapsus).

MOTH MULLEN.
(Verbascum blattaria).

FROM "NATURE'S GARDEN"
COPYRIGHT 1900, BY
DOUBLEDAY, PAGE & COMPANY.

The flowers produce an abundant nectar, which attracts bumblebees, butterflies, and humming-birds; these, by transferring the pollen from flower to flower, assist in the fertilization of the developing seeds. The ordinary bees are barred from the sweets of this plant because of their short tongues, though some forms will cut a hole in the side of the corolla and obtain the nectar in this manner.

It is said that certain Indian tribes use this bark in preparing a tea that is nearly as palatable as that made from the ordinary tea of commerce.

THE MULLEIN

Of the one hundred and twenty-five species of Mullein that are native to the Old World, five have become naturalized in the United States. The Great Mullein, so familiar in dry, open fields, was originally christened by Pliny, and has since received over forty English names of a less classical origin and significance.

The great mullein varies in height from two to seven feet. The stem is stout, very woolly, with branching hairs. The oblong, pale green, velvety leaves form a rosette on the ground or alternately clasp the stem. The flowers, which are about an inch in diameter, are clustered around a thick, dense spike, and have two long and three short stamens, so arranged as to materially assist the process of cross-fertilization, which is largely carried on by bees. It is interesting to note in connection with the thick, woolly covering of the plant that many vegetable forms are so protected when exposed to intense heat or cold. This is true of most Alpine

and desert forms, and the value of such a protection to the mullein will be seen when it is remembered that the plants are always found in open, dry, stony fields, exposed to the fierce heat of the sun, and afforded no protection for the rosettes of year-old plants, which must survive the winter in order to send up the flower stalk the second spring.

The Moth Mullein is a far more attractive and graceful plant than the form previously described. The specific name was derived from the idea that the plant would kill the cockroach (Blatta). It was supposed that moths would not go near the plant, and it was quite a general custom in New England to pack these plants or flowers with clothing or furs in order to keep out moths. The stamens are similar to those of the great mullein, except the filaments are tufted with violet hairs. The flowers are yellow or white, on long, loose racemes. The erect, slender stem is usually about two feet in height, and as a rule there are no leaves present at the flowering time. C. S. Raddin.

THE MALLOWS*

A number of interesting plants are found grouped under the name of the Mallow family. They are the common mallow, a weed of waysides and cultivated grounds; the Indian Mallow or Velvet-leaf, with its large, velvety leaves and yellow flowers, a visitor from India, which has escaped from cultivation and become a pest in corn and grain fields and waste places; the Musk Mallow, which has also escaped from our gardens; the Marsh-Mallow, the root of which abounds in a mucilage that is extensively used in the manu-

345

SWAMP ROSE-MALLOW.
(Hibiscus Moscheutos).

FROM "NATURE'S GARDEN"
COPYRIGHT 19[illegible], BY
DOUBLEDAY, PAGE & COMPANY

facture of confections; the Hollyhock of our gardens, which was originally a native of China, and the beautiful Rose-Mallow of our illustration.

The mallow family includes about eight hundred species which are widely distributed in the temperate and tropical countries.

All are herbs. Most of those found in the United States have been introduced from Europe and Asia. Only a very few are native, and no one of these is very common.

The flowers and fruits are all similar in structure to that of the common hollyhock.

The disk-like fruits of the common round-leafed mallow of our door-yards are often called "cheeses" by the children and are frequently gathered and eaten by them. The cotton plant, one of our most important economic plants, is also closely related to the mallow. The cotton of commerce is the woolly hair of the seeds of this plant, which is a native of nearly all tropical countries, and is cultivated in temperate regions.

The beautiful rose-mallow has its home in the brackish marshes of the Atlantic seacoast. It is also occasionally found on the marshy borders of lakes and rivers of the interior.

The plants grow to the height of from three to eight feet. The leaves are egg-shaped and the lower ones are three-lobed. The under side of the leaves is covered with fine and soft whitish hairs.

The flowers, produced in August and September, are large, varying from four to eight inches in diameter, and may be solitary or clustered at the top of the stem. The

color of the petals is usually a light rose-pink, but occasionally white, with or without crimson at their bases.

THE BLUE GENTIANS

The genus *Gentiana* includes nearly two hundred species, distributed from boreal to tropical regions, although the majority are found in the north temperate zone. A large number of species are found in Europe, more than sixty having been reported from Russia, and there are nearly one hundred in North America. Several very beautiful forms come from the Swiss Alps, which rarely attain a height of more than three or four inches. The deep blue flowers of these diminutive specimens retain their color for years after being pressed for the herbarium, thus differing from many of the larger forms whose corollas quickly fade.

One of the most attractive and familiar of the gentians is the Fringed or Blue Gentian. It is generally found in low grounds, along water-courses or ditches, and while quite generally distributed, it is sparing of its favors, as the long peduncles that terminate the stems or simple branches support but a single flower. The plant grows to a height of from one to two feet, and the leaves, placed opposite to each other, have rounded or heart-shaped bases attached directly to the stems, entire edges, and tapering points. The sky-blue flower is bell-shaped, nearly two inches long, and with the lobes strongly fringed. This is partially enclosed by a calyx, which is nearly as long as the corolla.

A much more common form, found growing in field and

FRINGED GENTIAN.
(Gentiana crinita).

CLOSED OR BLIND GENTIAN.
(Gentiana Andrewsii).

FROM "NATURES GARDEN"
COPYRIGHT 1900 BY
DOUBLEDAY, PAGE & COMPANY

503

SEA OR MARSH PINK.
(Sabbatia stellaris.)

FIRE-WEED.
(Chamaenerion angustifolium.)

woodlands, is the closed gentian. The fanciful name, Cloistered Heart, has been given to the plant because of the story that once a fairy queen sought to elude pursuit by secreting herself in the flower of a fringed gentian. In order that she might be more effectually shielded, the plant closed the lobes of its corolla, and in gratitude the queen decorated the interior of the flower with brilliant stripes. In order to preserve this fairy painting, the flowers have remained closed ever since. CHARLES S. RADDIN.

THE FIRE-WEED OR GREAT WILLOW-HERB*

Scattered throughout the world, but more abundant in the temperate regions of America, there are three hundred and fifty species of plants that are closely related and grouped by the botanists as the evening primrose family.

This family includes a number of interesting plants. Here are classed the fuchsias, or ladies' eardrops, of which there are many brilliant varieties under cultivation as house plants. These are natives of the mountain regions from Mexico southward. Another cultivated plant is the Clarkia, a native of Oregon and California.

The Fire-weed is a plant of the open country and not of the forest. It must have a great deal of sunshine. When its seeds fall in the deep shade of a dense forest, where the rays of the sun penetrate but a short distance, if at all, they cannot grow. But let the woodman or a fire lay low or destroy the noble growth of trees, then there is soon a transformation, the landscape is enlivened by the bright flowers of the fire-weed.

THE SEA OR MARSH PINK

The Sea or Marsh Pink, or the Rose of Plymouth, as it is frequently called, is a member of the beautiful gentian family. The genus Sabbatia, a name adopted in honor of an Italian botanist, includes about fourteen species, all natives of eastern North America and Mexico.

Our illustration is taken from *Nature's Garden,* and Neltje Blanchan, its author, writes as follows regarding those species of the marsh pinks that are confined to the vicinity of the Atlantic Ocean: "Three exquisite members of the Sabbatia tribe keep close to the Atlantic Coast in salt meadows and marshes, along the borders of brackish rivers, and, very rarely, in the sand at the edges of fresh-water ponds a little way inland. From Maine to Florida they range, and less frequently are met along the shores of the Gulf of Mexico so far as Louisiana. How bright and dainty they are! Whole meadows are radiant with their blushing loveliness."

THE ARROW HEAD

The Arrow Head is one of our most familiar plants, quite as well known because of its beautiful arrow-shaped leaves as for its showy white flowers. It is interesting and conspicuous among the rushes and sedges that abound in the sluggish waters that border lakes and streams. It must have sunshine and well illustrates the words of Thoreau: "Rivers and lakes are the great protectors of plants

BLACK COHOSH.
(Cimicifuga racemosa.)

ARROW HEAD.
(Sagittaria latifolia.)

FROM "NATURE'S GARDEN"
COPYRIGHT 1900, BY
DOUBLEDAY, PAGE & COMPANY.

against the aggressions of the forest, by their annual rise and fall keeping open a narrow strip where these more delicate plants have light and space in which to grow."

There are about twenty-five species of the genus *Sagittaria,* to which the plant of our illustration belongs. These inhabit both temperate and tropical regions. When the arrow head grows in water leaves are produced under water that do not have the arrow shape. These are not produced on those plants that grow on wet, muddy banks.

Two kinds of flowers are produced by this plant — the male and the female. The male flowers are the large white ones with a golden center formed by the group of yellow stamens. The female flowers are lower on the flower stalk and are dull green and unattractive.

THE BLACK COHOSH

The Black Cohosh, or Black Snakeroot, grows in rich woods from Canada nearly to the Gulf of Mexico. It is a conspicuous plant, with its long stem, which sometimes grows to a height of eight feet, and its large compound leaves, as well as with its long raceme of numerous small white flowers. This raceme during the ripening of the fruit often acquires a length of two to three feet.

This plant is sometimes called bugbane. The black cohosh is held in high repute by some Indians as a cure for the bite of poisonous snakes, as well as powerful aid in driving away insects. Were it not for the strong, disagreeable odor of the flowers, which are only frequented by those flies which enjoy the odor of carrion, with its "tall

white rockets shooting upward from a mass of large, handsome leaves," it would be a striking ornament for the flower garden.

THE PRIMROSE

Among the many beautiful blossoms to be found in the field, the forest, or the garden, probably none have served to inspire the poet more than the Primrose and its near relative, the English cowslip. Someone has said that "no flowers typify the beautiful more strongly than those of the primrose, which, though showy, are delicate and seem inclined to retire to the shade of the plant's leaves."

These plants belong to the primrose family, which includes twenty-eight genera and over three hundred and fifty species. Nearly all are natives of the Northern Hemisphere, some being found as far north as Greenland (the Greenland primrose). Some of the species are Alpine, and a few are found in the southern portions of South America and Africa. One of the most interesting wild species of this family is the shooting star, or American cowslip, which grows abundantly on the prairies of the eastern portion of the United States.

The family, as a whole, seems to have no economic value of importance and are of use to man simply to beautify his surroundings. Many of the species are very interesting to the scientific observer, for the structure of their flowers is such that they are peculiarly adapted for cross-fertilization. This character has made it possible for the floriculturist to produce many of the beautiful forms that are found in cultivation.

PRIMROSE.
⅔ Life-size.

COPYRIGHT 1900, BY A. W. MUMFORD, CHICAG

COMMON PURPLE VIOLET.
(*Viola obliqua.*)

LIVERWORT.
(*Hepatica Hepatica.*)

FROM "NATURE'S GARDEN."
COPYRIGHT 1892 BY
LOUIS ESTAU, PAGE & CO., BOSTON.

The common or English primrose, by careful culture, produces a wonderful number of variations. The wild forms produce only yellow single flowers, while from those under cultivation are developed numerous varieties, both single and double, which vary greatly in color — red, pink, white, purple, and many shades of each.

The cowslip primrose is also a native of England. The flowers are yellow and nodding, and the plants emit a strong odor of anise. W. K. Higley.

THE VIOLET

With the exception of the rose, no other plant is so widely distributed and at the same time so universally admired as the Violet. Not alone is it esteemed because of its beauty and fragrance, but a wealth of romance, of historical associations, and mythical lore have clustered around the purple blossoms, endearing them to the poet and scientist alike.

The violet was formally baptized with the ancient Latin name Viola in 1737. Since that time, by some strange oversight, botanists have allowed the name to remain unchanged. Two hundred and fifty species of the violet have been described, although a more careful study of the genus has reduced the number to one hundred or more species. Three-fourths of these forms are found in the temperate Northern Hemisphere and the balance in the southern. Under these diverse conditions of growth the plants assume many seemingly unnatural characteristics. Thus, in Brazil, a species of violet is eaten like spinach, while others

found in Peru are violent purgatives. Among certain Gaelic tribes the plants are highly esteemed as a cosmetic, and the ancients largely used the flowers to flavor wines.

C. S. Raddin.

THE ROUND-LOBED LIVERWORT*

The life of this plant is poetical. During the summer months a luxuriant growth of leaves is produced. As cold weather approaches these lie down upon the ground and are soon covered by the falling leaves which have been nipped from the trees by bite of the frost king. Soon, too, they are covered with snow. In this warm cradle they sleep through the winter, yet, as it were, with open eyes for the dawn of spring. Had the Hepatica the power of reason, we would say that it longed for spring, for after the first few warm days that herald the approach of that season there is activity in every part of the plant. It does not wait to produce new leaves, but in an incredibly short time sends up its flower stalk and spreads its blue, purple, or white petals to the warm rays of the sun. The hepatica is truly a harbinger of spring, and in eastern North America, from southern British America to the Gulf of Mexico, its appearance introduces the new season.

CLEMATIS

The term Clematis is commonly used in a generic sense, referring to a number of species. They are perennial herbs or vines, rather woody, and climbing by the bending or

COMMON CLEMATIS.
(Clematis virginiana)

FROM "WILD FLOWERS OF NORTH AMERICA."
COPYRIGHT 1879, BY S. E. CASSINO, BOSTON.

clasping of leaf-stalks. The leaves are pinnate, variously cut or lobed, opposite; the flowers are showy, variously colored, and with only one floral covering, namely, the calyx (sepals), the corolla (petals) being wanting or rudimentary. The various species belong to the Crowfoot family.

The plants are extensively cultivated as ornamental plants. The common clematis, Traveler's Joy, or Virgin's Bower, is a climbing plant with three smooth leaflets which are more or less cut or lobed and heart-shaped at the base. The flowers are white or whitish. It is quite common along river banks and flowers in July and August.

In the language of flowers clematis signifies artifice and mental beauty. On the continent of Europe *clematis erecta* and *clematis flammula* are used by beggars to produce artificial ulcers on their limbs to incite pity. In America, according to Geyer, the roots of a species of clematis are used by the Indians as a stimulant to horses which fall down at the races. The scraped end of the root is held to the nostrils of the fallen animal, which begins to tremble, and then, rising, is conducted to water to refresh itself.

As already indicated, there are many species of clematis in America, Europe, Asia, and India, and in other countries and islands. Besides the many culture varieties derived from wild species directly, there are numerous varieties the result of artificial crossing (cross-pollination), of which the following are, perhaps, the most handsome: The Jackmann, John Gould, Lucy Lemoine, Miss Bateman, Prince of Wales, and Sir Garnet Wolseley.

Clematis makes beautiful arbor plants and may be trained to almost any sort of support. They require con-

siderable sunlight and fairly good soil. They are propagated from cuttings and grafting. A. SCHNEIDER.

SOAPWORT OR BOUNCING BET*

The plant commonly called Soapwort or Bouncing Bet also bears other popular names, many of which are purely local. Some of these are hedge pink, bruisewort, sheepweed, old maid's pink, and Fuller's herb. It bears the name soapwort because of a substance called saponin which is a constituent of its roots and causes a foaming that appears like soap suds when the powdered root is shaken with water.

Soapwort belongs to a large group of plants called the Caryophyllaceæ, or pink family. In this family there are about fifteen hundred species. These are widely distributed, but are most abundant in the Northern Hemisphere, extending to the Arctic regions and to the tops of very high mountains. The popular and beautiful carnations and some of the most common plants that grow abundantly in waste places also belong to the pink family. The soapwort comes to us from Europe, where, in some localities, it is a common wild flower. In this country, when it was first introduced, it was simply a pretty cultivated garden plant. However, it lives from year to year and spreads by means of underground stems. It was not very long before it had escaped from yards to roadsides, where frequently large patches may be seen. The flowers are large and quite showy. The color of the petals is usually pinkish-white.

SOAPWORT OR BOUNCING BET.
(*Saponaria officinalis.*)

SNAKE-HEAD OR TURTLE-HEAD.
(*Chelone glabra.*)

FROM "NATURES GARDEN"
COPYRIGHT 1900 BY
DOUBLEDAY, PAGE & COMPANY

415 MOUNTAIN LAUREL OR CALICO-BUSH.
(Kalmia latifolia.)

TRAILING ARBUTUS OR MAYFLOWER.
(Epigaea repens.)

FROM "NATURES GARDEN"
COPYRIGHT 1903 BY
DOUBLEDAY, PAGE & COMPANY

TURTLE-HEAD OR SNAKE-HEAD*

The Turtle-head, or Snake-head, is one of three species that are natives of eastern North America. This plant is well supplied with common names, as it is also called shell-flower, cod-head, bitter-herb, and balmony.

Though commonly found in low altitudes, it is found in moist places in the Adirondacks, even at a height of three thousand feet. This plant is not rare, and, with its upright stem and its rather large and clustered white or slightly rose-colored flowers, it is a dignified and beautiful feature of any floral community.

THE TRAILING ARBUTUS*

The Trailing Arbutus belongs to the Heath family and constitutes the only species of the genus. Like the partridge berry, which is often associated with it in pine woods and sandy soils, it is still in a state of transition, although it has been developing for centuries. As a rule, plants have the stamens and pistils in the same blossom, or part in one and part in another. The May-flower, however, does not carry out this arrangement. Either the antlers or the stigmas are abortive or partially so, or, in other words, the perfect stigmas are usually associated with abortive antlers, and *vice versa*. In this manner nature has wisely provided for cross-fertilization, which is accomplished largely by insects, as the structure of the plant is not adapted to wind fertilization. The chosen agents for this process are honey bees and

a few early moths and butterflies, to which the nectar is served by this beautiful Hebe of the spring and who carry the pollen from one flower to another.

THE MOUNTAIN LAUREL*

The genus Kalmia includes six known species, five of which are natives of eastern North America and one a native of Cuba. They are all beautiful shrubs, varying in height from a few inches to several feet.

The plant of our illustration is a native of the eastern portion of the United States, where it grows in sandy or rocky woods and is more abundant in mountainous regions. This shrub, which grows to a maximum height of twenty feet, is a superb object early in June, when it is covered with corymbs of rather large pink or pinkish-white flowers and numerous evergreen leaves.

Easily cultivated and highly ornamental, it has been introduced into the greenhouses and gardens of this and European countries.

In spite of the beauty of this plant, it has a bad reputation, for its leaves are narcotic and poisonous to some animals. "Even the intelligent grouse, hard pressed with hunger when deep snow covers much of their chosen food, are sometimes found dead and their crops distended by these leaves."

ROBIN'S PLANTAIN OR BLUE SPRING DAISY.
(Erigeron pulchellus.)

BLUE VERVAIN OR WILD HYSSOP.
(Verbena hastata.)

FROM "NATURE'S GARDEN"
COPYRIGHT 1900, BY
DOUBLEDAY, PAGE & COMPANY

THE VERBENAS*

The name Verbena, in the language of flowers, signifies enchantment.

The genus Verbena includes about one hundred and ten species, often of a weedy character.

The Blue Vervain is one of the weedy members of the genus. It is common along our waysides, and, with its erect form and long spikes of blue flowers, would be quite attractive could the flowers all mature at the same time. It has frequently been placed under cultivation, but has little value as a garden flower. But in the waste grounds of roadsides it is a pleasing sight even if its leaves are gray with dust.

This plant is sometimes called Simpler's Joy. It was given this name because in years gone by it was a popular herb with the "simplers," or gatherers of medicinal plants.

THE BLUE SPRING DAISY*

The botanist knows this plant of the hills and banks as one of the species of the genus *Erigeron.* This name is indicative of one of its characteristics. It is from two Greek words meaning spring and old man. Old man in the spring, or early old, is an appropriate name, for the young plants are quite hoary and this hoariness remains throughout its life.

The Blue Spring Daisy is not alone, for it has about one hundred and thirty sister species widely distributed throughout the world, but they are more abundant in the

Americas, nearly seventy of these occurring in North America.

This unassuming plant frequently grows in large patches, yet does not crowd its fellows; often it grows in localities which the more delicate and brilliant of the early flowers are wont to shun.

Though the species of Erigeron are coarse-growing and unpretentious plants, they lend themselves readily to garden cultivation. They are easily propagated and make good borders, for they are much more beautiful when massed than when allowed to develop as single plants. The forms vary greatly in color — orange, creamy white, rose, violet, purple, and bluish illustrate the range of color. The yellow centers heighten the color effect.

THE THISTLE

The Thistle group is the most primitive of the Composite family, and it bears evidence of a vast evolutionary history. There are one hundred and seventy-five living species, which are distributed over Europe, Asia, Africa, North and South America. The plants seem able to adapt themselves to almost any conditions, and their unpleasant spines are found bidding defiance to the reindeer near the Arctic circle, as well as successfully measuring strength with the prickly cactus and acacias of the tropics. On our own prairies only plants thus armed stand much show to survive the herds of cattle that wander over them, and this protection, together with their great productiveness, have rendered thistles such a nuisance and menace to agricultural interests as to neces-

463

BUR OR SPEAR THISTLE.
(*Carduus lanceolatus.*)

PASTURE OR FRAGRANT THISTLE.
(*Carduus odoratus.*)

FROM "NATURE'S GARDEN"
COPYRIGHT 190

sitate legislative action looking to their extermination. The Russian and Canadian thistles are the worst offenders, and where they once obtain a foothold they, as a rule, remain. The unpleasant qualities of the thistle, however, served to bring about its adoption as the national emblem of Scotland. The story relates that during the eighth century the invading Danes, while stealing up to the Scotch camp under cover of darkness, passed over a patch of cotton thistle and the sudden cries of the injured men warned the guards, and thus the army was saved. Achaius, King of Scotland, adopted the plant as his emblem in recognition of this service, but it was not made a part of the national arms until the middle of the fifteenth century.

The origin of the Scottish order of the Thistle, or St. Andrew, is somewhat uncertain. In 1687 it was restored to favor by James II. of England, and was given much prominence during the reign of Queen Anne. The membership was limited to from twelve to sixteen peers of the realm, the insignia being a golden collar composed of sixteen thistles, from which hung a St. Andrews' cross. C. S. Raddin.

CHAPTER II

SPICES, ETC.

By Dr. Albert Schneider

Spices of various kinds have been in use since the history of man. Their purpose has been to give an agreeable flavor to food, rendering it more palatable, and to stimulate digestion. Most of the spice-yielding plants are tropical or subtropical, and are all extensively cultivated. Any part of the plants may be used. In the case of the peppers and allspice, it is the dried fruit which is employed; in the case of cinnamon, the bark is used. Ginger is an underground stem or rhizome; nutmeg is a seed; mace is a fruit covering (arillus); clove is a flower; mother-of-clove, a fruit.

A moderate use of spices does, perhaps, no harm, but an excessive use of these artificial adjuncts to digestion causes an inflammatory condition of stomach and liver. They also blunt the taste sense. Persons who never use spices are not sufferers, as has been proven repeatedly.

The Dutch are the chief promoters of the spice industry and were the first to cultivate spices on a large scale on the various tropical islands in their possession.

CINNAMON

The Cinnamons of the market are the inner barks obtained from trees of tropical countries and islands. The plants are quite ornamental; twenty to forty feet high; smooth, enduring, green, simple, and entire leaves. The flowers are small and very insignificant in appearance.

Cinnamon is an old-time, highly prized spice.

There are several varieties of cinnamon upon the market. Cassia cinnamon, which is a Chinese variety, is obtained from *Cinnamomum cassia.* The bark is quite thick and contains only a small amount of volatile or ethereal oil. It is of little value, yet it is exported on a large scale. It forms the cheap cinnamon of the market. There are other Chinese cinnamons of good quality which constitute the principal commercial article. The Saigon cinnamon is by far the best article. It also is Chinese, obtained from an undetermined species. It is the strongest and spiciest of the cinnamons, and it is the only variety official in the United States Pharmacopœia. The bark is of medium thickness, deep reddish-brown, and rich in volatile oil. The Ceylon cinnamon, from India, is noted for the delicacy of its flavor, but it contains comparatively little volatile oil. The bark is very thin and of a lighter brown color than that of the Saigon cinnamon.

Nearly all of the cinnamon of the market is obtained from cultivated plants. There are large plantations in southeastern China, Cochin-China, India, Sunda Islands, Sumatra, Java, and other tropical countries and islands. In

COPYRIGHT 1900, BY A. W. MUMFORD, CHICAGO

CLOVE.

COPYRIGHT 1900, BY A. W. MUMFORD, CHICAGO

A. Flowering branch. 1. Flower bud. 2. Sectional view of same. 3. Stamens. 4. Pollen. 5. Ovary and section of same. 7-9. Ovule and sections of same.

many instances little or nothing is known regarding the cultivation, collecting, and curing of cinnamons. As a rule, the trees are pruned for convenience in collecting the bark. In the better-grade cinnamons the bark from the younger twigs only (one and one-half to two years old) is collected.

Description of plate: A, flowering twig; 1, diagram of flower; 2, 3, flower; 4, stamen; 5, pistil; 6, fruit.

CLOVES

Cloves are among our favorite spices, even more widely known and more generally used than ginger. They are the immature fruit and flower-buds of a beautiful, aromatic, evergreen tree of the tropics. This tree reaches a height of from thirty to forty feet. The branches are nearly horizontal, quite smooth, of a yellowish-gray coloration, decreasing gradually in length from base to the apex of the tree, thus forming a pyramid. The leaves are opposite, entire, smooth, and of a beautiful green color. The flowers are borne upon short stalks, usually three in number, which extend from the apex of short branches. The calyx is about half an inch long, changing from whitish to greenish, and finally to crimson. The entire calyx is rich in oil glands. The petals are four in number, pink in color, and drop off very readily. The stamens are very numerous. All parts of the plant are aromatic, the immature flowers most of all.

The clove-tree was native in the Moluccas, or Clove Islands, and the southern Philippines. Now cloves are extensively cultivated in Sumatra, the Moluccas, West Indies, Penang, Mauritius, Bourbon, Amboyne, Guiana,

Brazil, and Zanzibar — in fact, throughout the tropical world. Zanzibar is said to supply most of the cloves of the market.

The cultivation of cloves in Zanzibar is conducted somewhat as follows: The seeds of the plant are soaked in water for two or three days, or until germination begins, whereupon they are planted in shaded beds about six inches apart, usually two seeds together, to insure against failure. The young germinating plants are shaded by frameworks of sticks covered with grass or leaves. This mat is sprinkled with water every morning and evening. The young plants are kept in these covered beds for nine months, after which they are ready for transplanting.

Transplanting must be done carefully, so as not to injure the roots. The plant is dug up by a special hoe-like tool, lifted up in the hand with as much soil as possible, placed upon crossed strips of banana fibers, which are taken up by the ends and wrapped and tied about the plant. The plant is now carried to its new locality, placed in a hole in the soil, the earth filled in about it, and finally the banana strips are cut and drawn out.

The transplanted clove plants are now carefully tended and watered for about one year, but they are not shaded, as during the first year of their existence. Usually many of the transplanted plants die, which makes replanting necessary. This great mortality, it is believed by some, might be reduced very materially by shading the recently transplanted clove-trees for a time.

The clove-tree may attain an age of from sixty to seventy years, and some have been noted which were ninety

COPYRIGHT 1900, BY A. W. MUMFORD, CHICAGO

A. Flowering branch. 1. Pistil surrounded by stamens. 2. Longitudinal section of same. 3. Cross section of same. 4. Pollen. 5. Ovary. 6. Section of same. 7-8. Mature fruit. 9. Nutmeg covered with mace. 10. Bare nutmeg. 11. Sectional view. 12. Embryo; see also 11.

years old and over. The average life of the plantation clove-trees is, however, perhaps not more than twenty years. The trees begin to yield in about five years after planting. The picking of the immature flowers with the red calyx is begun in August and lasts for about four months. From two to four crops are harvested each year.

Explanation of plate: A, flowering branch, nearly natural size; 1, floral bud; 2, floral bud in longitudinal section; 3, stamens; 4, pollen grains; 5, ovary in transverse section; 6, fruit about natural size; 7, fruit in transverse section; 8, embryo; 9, part of embryo.

THE NUTMEG

The Nutmeg is the spice obtained from a medium-sized evergreen tree reaching a height of from twenty-five to forty feet. This tree is dicœcious; that is, the male flowers and the female flowers are borne upon different plants. The male flower consists of a column of from six to ten stamens enclosed by a pale yellow tubular perianth. The female flowers occur singly, in twos or threes, in the axils of the leaves; they also have a pale yellow perianth. The ovary has a single seed, which finally matures into the nutmeg and mace. The mature seed is about one and one-fourth inches long and somewhat less in transverse diameter, so that it is somewhat oval in outline. It is almost entirely enveloped by a fringed scarlet covering known as arillus or arillode (mace). The entire fruit, nut, mace, and all, is about the size of a walnut, and, like that nut, has a thick outer covering, the pericarp, which is fibrous and attains a thickness

of about half an inch. At maturity the pericarp splits in halves from the top to the base or point of attachment. The leaves of the nutmeg tree are simple, entire, and comparatively large.

The nutmeg is now cultivated in the Philippines, West Indies, South America, and other tropical islands and countries. The botanic gardens have been largely instrumental in extending nutmeg cultivation in the tropical English possessions.

The trees are produced from seeds. After sprouting, the plants are transferred to pots, in which they are kept until ready for the nutmeg plantation. Transferring from the pots to the soil must be done carefully, as any considerable injury to the terminal rootlets kills the plants. A rich, loamy soil with considerable moisture is required for the favorable and rapid growth of the plants.

Description of plate: A, branch with staminate flowers; 1, stamens magnified; 2, longitudinal view of stamens; 3, transverse section of stamens; 4, pollen-grains; 5, pistillate flower; 6, pistil; 7, fruit; 8, half of pericarp removed; 9, nut with arillus (mace); 10, nut without mace; 11, nut in longitudinal section; 12, embryo.

GINGER

The well-known spice, Ginger, is the underground stem *(rhizome)* of an herbaceous, reed-like plant known as *Zingiber officinale.* The rhizome is perennial, but the leaf and flower-bearing stems are annual. The stems are from three to six feet high. The leaves of the upper part of the stem

GINGER.

COPYRIGHT 1900, BY A. W. MUMFORD, CHICAGO

are sword-shaped; the lower leaves are rudimentary and sheath-like. The flowers occur in the form of conical spikes borne upon the apex of stems which bear only sheath-like leaves.

The ginger plant is said to be a native of southern Asia, although it is now rarely found growing wild. It is very extensively cultivated in the tropical countries of both hemispheres, particularly in southern China, India, Africa, and Jamaica. The word ginger is said to have been derived from the Greek "*Zingiber*," which again was derived from the Arabian "*Zindschabil*," which means the "root from India." It is further stated that the word was derived from Gingi, a country west of Pondecheri, where the plant is said to grow wild.

True ginger must not be confounded with "wild ginger," which is a small herbaceous plant of the United States. The long, slender rhizomes of "wild ginger" have a pungent, aromatic taste similar to ginger.

At the present time Jamaica supplies the United States with nearly all of the ginger, and this island is, therefore, known as "the land of ginger." Cochin-China and Africa also yield much ginger.

Explanation of plate: A, plant, about natural size; 1, flower bud; 2, flower; 3, outer floral parts separated; 4, longitudinal section of flower; 5, nectary with the rudimentary and perfect stamens; 7, upper end of style with stigma; 8 and 9, ovary in longitudinal and transverse sections.

RED PEPPER

Red Pepper is a spreading, typically herbaceous plant belonging to the night shade family. Stems are soft and green in color. Leaves are simple, margin entire, ovate, pointed, and stalked. The flowers are not especially showy, white, single, axillary, rarely in twos. The fruit, which is botanically a berry, is green at first, changing to bright red on ripening. It varies in size and form.

The fruits are usually collected before they are fully ripened, while they are still of a green color, and dried, whereupon they assume a bright red color characteristic of red pepper. They have a very pungent taste and constitute one of the most highly prized and most extensively used spices, being added to soups, sauces, meats, salads, mixed pickles, etc. It is a very useful, stimulating tonic, especially indicated in what is known as atonic dyspepsia, or dyspepsia due to a sluggish action of the secreting glands of the stomach.

As a spice the powdered dried fruits are used. For pickling the green fruits are preferred. The small pods known as chillies are used principally in preparing a sauce universally known as chili sauce. Red pepper is frequently used as an adulterant of vinegar and brandy, to produce the desired pungency. It is stated that an excessive use of red pepper produces disorders of the stomach, which is apparently not true from the experience of those of the tropics, who consume it in enormous quantities. Red pepper has been employed in the treatment of rheumatism, gout,

RED PEPPER.
(Capsicum annum, Varieties.)
About Life size.

COPYRIGHT 1903, BY A. W. MUMFORD, CHICAGO

A. W. MUMFORD, CHICAGO

as a gargle in tonsilitis, sore throat, etc. Its principal use at the present time is that of a spice and as a remedy for atonic dyspepsia. Powdered red pepper is added to snuff, and it is certainly very effective in causing sneezing. Those who work with red pepper find it necessary to protect the nostrils against the irritating fine powder.

PEPPER

The plants yielding the black and white pepper of the market are climbing or trailing shrubs. The stem attains a length of from fifteen to twenty-five feet. The climbing portions cling to the support (usually large trees) by means of aerial roots similar to the ivy. The young fruit is grass-green, then changes to red, and finally to yellowish when ripe. In southern India the flowers mature in May and June and the seeds ripen five or six months later.

Pepper is a native of southern India, growing abundantly along the Malabar coast. It thrives best in rich soil, in the shade of trees to which it clings. It also grows in Ceylon, Singapore, Penang, Borneo, Luzon, Java, Sumatra, and the Philippines. It is cultivated in all of the countries named, especially in southwestern India. Attempts at its cultivation have been made in the West Indies.

In India the natives simplify the cultivation of pepper by tying the wild-growing vines, to a height of six feet, to neighboring trees and clearing away the underwood, leaving just enough trees to provide shade. The roots are covered with heaps of leaves and the shoots are trimmed or clipped

twice a year. They begin to yield about the fourth or fifth year and continue to yield for eight or nine years.

The chief use of pepper is that of a spice, added principally to meats, but also to other food substances. Applied externally, it is used as a counter-irritant in skin diseases. Italian physicians recommend it highly in malarial diseases.

Description of plate: A, flowering twig; 1, portion of spike; 2, ovary with stamens; 3, stamens; 4, young fruit; 5, 6, portions of spike; 7, 8, fruit.

VANILLA

Vanilla planifolia belongs to the Orchid family, though it has many characteristics not common to most members of the family. It is a fleshy, dark-green, perennial climber, adhering to trees by its aerial roots, which are produced at the nodes. The stem attains a length of many feet, reaching to the very tops of the supporting trees. The young plant roots in the ground, but as the stem grows in length, winding about its support and clinging to it by the aerial roots, it loses the subterranean roots and the plant establishes itself as a saprophyte, or partial parasite, life habits common to orchids. The leaves are entire, dark green, and sessile. Inflorescence consists of eight to ten flowers sessile upon axillary spikes. The flowers are a pale greenish-yellow, perianth rather fleshy and soon falls away from the ovary, or young fruit, which is a pod and by the casual observer would be taken for the flower stalk. The mature fruit is a brown curved pod six to eight inches long, smooth,

VANILLA.

COPYRIGHT 1901, BY A. W. MUMFORD, CHICAGO

A. Flowering twig. 1-3. Corolla. 4-5. Pistil. 6-7. Stamen. 9. Pollen. 10-11. Fruit. 12-13. Seed.

COFFEE

CHICAGO:
A. W. MUMFORD, PUBLISHER.

splitting lengthwise in two unequal parts, thus liberating the numerous very small oval or lenticular seeds.

There are a number of commercial varieties of vanilla named after the countries in which they are grown or after the centers of export, as Mexican, Vera Cruz, Bourbon, Mauritius, Java, La Guayra, Honduras, and Brazilian vanilla. The most highly valued Mexican variety is known as *Vanilla de leg* (leg meaning law). The pods are long, dark brown, very fragrant, and coated with crystals. Since vanilla is a costly article, adulteration is quite common. Useless pods are coated with balsam of Peru to give them a good appearance. Split, empty pods are filled with some worthless material, glued together, and coated with balsam of Peru.

Description of plate: A, flowering twig; 1, 2, 3, corolla; 4, 5, pistil; 6, 7, stamen; 9, pollen; 10, 11, fruit; 12, 13, seed.

COFFEE

Coffee is the seed of a small evergreen tree or shrub ranging from fifteen to twenty-five feet in height. The branches are spreading or even pendant, with opposite short-petioled leaves, which are ovate, smooth, leathery, and dark green. The flowers are perfect, fragrant, occurring in groups of from three to seven in the axils of the leaves. The corolla is white, the calyx green and small. The ovary is green at first, changing to yellowish, and finally to deep red or purple at maturity. Each ovary has two seeds, the so-called coffee beans.

The plant thrives best in a loamy soil, in an average

annual temperature of about 27 degrees C., with considerable moisture and shade. Most plantations are at an elevation of 1,000 feet to 2,500 feet above the sea level. In order to insure larger yields and to make gathering easier the trees of the South American plantations are clipped so as to keep their height at about 6 feet to 6.5 feet. The yield begins with the third year and continues increasingly up to the twentieth year. The fruit matures at all seasons and is gathered about three times each year. In Arabia, where the trees are usually not clipped, and, hence, comparatively large, the fruit is knocked off by means of sticks. In the West Indies and South America the red, not fully matured fruit is picked by hand. The outer hard shell (fruit coat, pericarp) is removed by pressure, rolling, and shaking. The beans are now ready for the market.

Description of plate: A, twig with flowers and immature fruit, about natural size; 1, corolla; 2, stamens; 3, style and stigma (pistil); 4, ovary in longitudinal section; 5 and 6, coffee bean in dorsal and ventral view; 7, fruit in longitudinal section; 8, bean in transverse section; 9, bean sectioned to show caulicle; 10, caulicle.

TEA

The highly esteemed drink, Tea, is made from the leaves and very young terminal branches of a shrub known as *Camellia Thea.* The shrub is spreading, usually two or three meters high, though it may attain a height of nine or ten meters. It has smooth, dark green, alternate, irregularly serrate-dentate, lanceolate to obovate, blunt-pointed,

TEA PLANT.
(Thea sineusis).

COPYRIGHT 1900, BY A. W. MUMFORD, CHICAGO

A. Flowering Branch. 1. Section of Flower. 2, 2. Stamens. 3. Section of Ovary. 4. Pistil and Calyx. 5, 6. Fruit. 7. Seed. 8. Section of Seed. 9. Embryo.

(Opp. Tea)

simple leaves. The young leaves and branches are woolly, owing to the presence of numerous hair-cells. The flowers are perfect, solitary or in twos and threes in the axils of the leaves. They are white and rather showy. Some authors state that they are fragrant, while others state that they are practically odorless. Stamens are numerous. The ovary is three-celled, with one seed in each cell, which is about the size of a cherry seed.

The tea-plant is no doubt a native of India, upper Assam, from whence it was early introduced into China, where it is now cultivated on an immense scale. It is, however, also extensively cultivated in various parts of India, in Japan, Java, Australia, Sicily, Corea, and other tropical and subtropical countries and islands. It is also cultivated to some extent in the southern United States, as in Carolina, Georgia, Mississippi, and California, but apparently without any great success.

The following are the principal teas of the market and the manner of their preparation:

1. Green Tea. — After collecting the leaves are allowed to lie for about two hours in warmed pans and stirred and then rolled upon small bamboo tables, whereupon they are further dried upon hurdles and again in heated pans for about one hour, accompanied by stirring. The leaves now assume a bluish-green color, which is frequently enhanced by adding Prussian blue or indigo. Of these green teas, the most important are Gunpowder, Twankay, Hyson, Young Hyson, Hyson Skin, Songla, Soulang, and Imperial.

2. Black Tea. — The leaves are allowed to lie in heaps for a day, when they are thoroughly shaken and mixed,

After another period of rest, two or three days, they are dried and rolled much as green tea. In the storing process the leaves undergo a fermentation which develops the aroma and the dark color. The following are the principal varieties; Campoe, Congou, Linki-sam, Padre Souchon (caravan tea), Pecoe, Souchong, and Bohe.

Explanation of plate: A, flowering branch, nearly natural size; 1, flower in section; 2, stamen; 3, ovary in transverse section; 4, pistil; 5 and 6, fruit, with seed; 7, seed; 8, seed in sections.

SUGAR-CANE

It is very doubtful whether sugar-cane occurs anywhere in the wild state, at present. Authorities are quite unanimous in expressing it as their opinion that its original home was India. It is a plant that has been under cultivation for many centuries.

There are many varieties recognized by cultivators, differing in color, texture, and other minor characteristics.

Since cane does not ripen fruit, it is propagated by transplanting the rhizomes and top portions of stem. The ripe cane is cut close to the ground, the leaves stripped off, and tassel cut off. It is then carted to the cane mill and passed between large rollers, which express the juice, which is then clarified by means of lime, animal charcoal, and blood. The juice is boiled until it acquires a proper tenacity, when it is passed into a cooler and allowed to crystallize. This sugar is then placed in large perforated casks and allowed to drain for two or three weeks, when it is packed into hogsheads and exported under the name of raw sugar or muscovado

SUGAR CANE.

(Saccharum officinarum).

A Plant (reduced). B Part of Stem, with Leaf. C Inflorescence. 1-6. Parts of Flower.

COPYRIGHT 19[illegible], BY A. W. MUMFORD, CHICAGO

sugar. The drainings form molasses. Raw sugar is taken to the sugar refinery and purified.

Sugar has innumerable uses. As an article of food it is not surpassed, though it cannot support life alone, because it contains no nitrogen. It is the important ingredient in candies, pastries, sweetened drinks, etc. Molasses and treacle are much used and must not be confounded with the sorghum molasses made from the sugar cane of the Central States. Molasses and treacle sometimes have a very peculiar and, to many, a very objectionable flavor, due to impurities present.

Molasses, as well as treacle, when fermented, gives rise to rum. The popular notion that sugar is injurious to teeth is without foundation.

In medicine sugar is employed to disguise the taste of disagreeable remedies and to coat pills. It has no direct curative properties in disease.

Description of plate: A, plant, much reduced; B, stem portion with leaf; C, inflorescence; 1-6, parts of flower.

CHAPTER III

MEDICINAL PLANTS

By Dr. Albert Schneider

Medicinal Plants are used in the treatment of diseases. The active principle is usually extracted in some manner, then given internally or applied externally. In some instances the dried plant or plant part is reduced to a powder and taken internally. Some medicinal plants are found in the wild state only, but most of them are also cultivated.

Medicinal plants have been in use since time immemorial, and at some time nearly every known plant has been tested and used medicinally, whether it possesses any healing powers or not. The tendency at the present time is to reduce the number of drugs, and, hence, drug-yielding plants. Not so many years ago the physician prescribed hundreds of different species of plants, while the modern physician rarely uses more than twenty-five or thirty. Many plants still retained in the official list might as well be excluded, as they have practically no medicinal virtue.

Our most valuable medicinal plants are also poisonous, a fact well worth remembering. There are, however, many poisonous plants which are not used medicinally.

FOXGLOVE

The Foxglove is a biennial herb from two to seven feet in height, with a solitary, sparingly branched stem. The basal leaves are very large and broad, gradually becoming narrower and smaller toward the apex of the stem and its branches, dark green in color, pubescent, margin dentate, venation very prominent. The inflorescence is very characteristic. The large, numerous flowers are closely crowded and pendulous from one side of the arched stalk. The corolla is purple and spotted on the inside. It is a very handsome plant, widely distributed, preferring a sandy or gravelly soil in open woods. When abundant and in full bloom it makes a beautiful exhibit. It is a garden favorite in many lands.

Modern physicians consider digitalis one of the most important medicinal plants. It is a very powerful, hence very poisonous drug, its action being due to an active principle known as *digitalin.* Its principal use is in the treatment of deficient heart action.

For medicinal use the leaves from the wild-growing plants are preferred, because they contain more of the active principle. The leaves are collected when about half of the flowers are expanded, and, since it is a biennial, that would be during the second year. The first year leaves are, however, often used or added. Like all valuable drugs, it is often adulterated. The odor of the bruised green leaves is heavy or nauseous, while that of the dried leaves is fragrant, resembling the odor of tea. The taste is quite

COPYRIGHT 1900, BY
A. W. MUMFORD, CHICAGO.

FROM KŒHLER'S MEDICINAL-PFLANZEN.

SWEET FLAG.
(Acorus calamus.)

CHICAGO:
A. W. MUMFORD PUBLISHER

bitter. Formerly the roots, flowers, and seeds were also used medicinally.

Description of plate: A, B, plant somewhat reduced; 1, flower; 2, 3, 4, stamens; 5, pollen; 6, 7, style and stigma; 8, 9, ovary; 10, fruit; 11, 12, 13, seed.

CALAMUS

Acorus calamus, commonly known as Calamus, Sweet Flag, and Cinnamon Sedge, is a reed-like plant common in Europe and North United States. It grows in swamps, marshes, and very moist places. It is a herbaceous perennial growing from spreading, fleshy rhizomes. The long, sword-like, deep green pointed leaves grow up from the rhizomes.

Calamus has ever been a favorite popular remedy. Its principal use seems to have been that of a tonic and blood purifier, for which purpose bits of the dried rhizomes are masticated and the saliva swallowed. It undoubtedly is a tonic, and it also has a beneficial stimulating and antiseptic effect upon gums and teeth. Chewing the rhizomes is also said to clear the voice. Calamus is, or has been, used in flavoring beer and gin. Country people add it to whisky, wine, and brandy to make a tonic bitters for the weak and dyspeptic. It is said that the Turks employ it as a preventive against contagious diseases. In India it is used to destroy vermin, especially fleas. In England it is employed in the treatment of malaria.

At the present time calamus is no longer extensively employed in medicine. It is considered as a stimulating, aro-

matic, and bitter tonic. It is perhaps true that its value as a tonic is at present somewhat underestimated by the medical profession. It is also serviceable in flatulent colic, and in what is designated as atonic dyspepsia. It is added to other medicine, either as a corrective, or adjuvant.

Description of plate: A, rhizome and basal portion of leaves; B, upper end of leaf with inflorescence (spike); 1, 2, 3, 5, flowers; 4, stigma; 6, section of fruit; 7, stamens; 8, pollen grains.

THYME

The field or wild Thyme is a small, much-branched shrub, about one foot high, with rather slender, quadrangular, purplish, pubescent stems. Leaves small, opposite, sessile. Flowers numerous, in clusters in the axils of the upper leaves. Corolla purplish, irregular; calyx green and persistent. The plant is propagated by means of underground stems. It is far from being a showy plant.

This plant is closely related to the garden thyme, and grows profusely in meadows, fields, and gardens. Both species are very fragrant, and it is to this characteristic that they owe their popularity. The ancient Greeks and Romans valued thyme very highly and made use of it as a cosmetic, in medicine, and in veterinary practice, much as it is used at the present time. Thyme yields the oil of thyme, which is a valuable antiseptic, used as a gargle and mouth wash, for toothache, in dressing wounds and ulcers, also for sprains and bruises, in chronic rheumatism, etc. It finds extensive use in the preparation of perfumes and scented soaps; but its principal value is in veterinary practice. The herb is

CHICAGO
A. W. MUMFORD, PUBLISHER

FROM KŒHLER'S MEDICINAL-PFLANZEN.

MANDRAKE.

CHICAGO:
A. W. MUMFORD PUBLISHER.

much used as a flavoring agent in soups and sauces, in fomentations, in baths, and in the preparation of scented pillows.

Two kinds of oil of thyme appear upon the market, the red oil and the white oil. The latter is less aromatic, being the product of redistillation. The oil is also known as oil of origanum.

Although thyme is an insignificant plant, as far as appearances are concerned, yet it has been sung by many poets.

Description of plate: A, plant somewhat reduced; 1, 2, leaves; 3, flower bud; 4, 5, flower; 4, 5, 6, 7, 8, different views of flower; 9, flower without stamens; 10, stamens; 11, pollen grains; 12, 13, pistil; 14, developing fruit; 15, transverse section of fruit; 16, ripening fruit; 17, 18, 19, seed.

MAY-APPLE

The May-apple is a small perennial herb with long root-stalks or underground stems, a native of the United States and Canada, growing in rather moist woodlands. The entire plant attains a height of about twelve inches. The leaves are large, peltate (from *pelta,* small shield), margin deeply cleft, from five to nine lobed, lobes pendant, thus giving the leaf a semblance to an umbrella. It is remarkable that the flowerless plants have only one leaf, while the flowering specimens always have two, which are opposite upon the stem apex, carrying the flower in the bifurcation as shown in the illustration.

Each plant bears a single flower upon a drooping stalk.

The calyx consists of six greenish sepals, which, however, drop off as soon as the flower begins to unfold. The corolla consists of six or nine petals, which are quite large, thick, and pulpy, and of a creamy-white color. Authorities seem to differ as to the odor of the flower. Some speak of it as very fragrant; others designate it as nauseous, and others express no opinion. It is an undoubted fact that the rhizomes, stems, and leaves have a very heavy, nauseous odor, and it is not unreasonable to assume that this odor is traceable in flower and unripe fruit.

The flowers expand in May and the fruit ripens in August. The fruit is a berry about the size of a plum. At first green, it changes to a soft yellow at maturity. It is not unlike a tomato in general appearance. When fully ripe it has a fragrant odor and tastes somewhat like the paw-paw.

The principal use of the American mandrake is medicinal. It is a very efficient cathartic.

Description of plate: A, B, parts of the plant, about natural size; 1, flower bud; 2, flower; 3, stamens; 4, ovary; 5, fruit; 6, seed coat; 7, seed.

TOBACCO

The Tobacco plant is a tall herbaceous annual with large simple leaves and terminal inflorescence, belonging to the nightshade family, the members of which resemble each other in that they are more or less poisonous and in that they have a disagreeable, nauseous, heavy odor.

There are several species of tobacco, of which the above is the most highly valued, and they are all natives of warm

TOBACCO.
(Nicotiana tabacum).

A. W. MUMFORD, PUBLISHER, CHICAGO

CUBEBS.

CHICAGO:
A. W. MUMFORD, PUBLISHER.

countries, as southern Asia, India, South America, and the West Indies. Tobacco is very extensively cultivated in nearly all warm countries, especially in the southern United States and the West Indies.

Tobacco requires rich soil and careful cultivation. The seed is sown in a hotbed or in a sheltered place in the open. The plants are set from April to June. The ground is carefully tilled, freed from weeds, and the plants watched for cutworms and the big green tobacco worm, which are very destructive. Worms and eggs must be removed and destroyed. To increase the size of the leaves and hasten maturity, the flowering tops are broken off. When the leaves are matured, which is indicated by a yellowish mottling, the plants are cut off close to the ground, fastened in groups of six to eight, and dried.

All unprejudiced authorities are agreed that the habitual use of tobacco acts injuriously upon the system, no matter in what form or manner it is used.

Medicinally, tobacco is but rarely used now. With nonsmokers it is useful to relieve asthma. Formerly it was quite extensively employed in spasmodic affections and in parasitic skin diseases.

Description of plate: A, flowering stem; 1, floral parts; 2, stamen; 3, pollen; 4-8, ovary and pistil; 9, 10, seed.

CUBEBS

The Cubeb-yielding plant is not unlike the pepper plant, and belongs to the same family. The two resemble each other in general habits in the form of inflorescence and in

the fruiting. Cubebs were known to Arabian physicians as early as the ninth century, who employed them as a diuretic in kidney troubles. It was also known at that time that Java was the home of the plant. During the twelfth and thirteenth centuries it was employed medicinally in Spain. Originally it was doubtless employed as a spice, similar to pepper. At the beginning of the nineteenth century cubeb disappeared almost entirely from medical practice. About 1820 English physicians of Java again began to employ it quite extensively.

As in the case of black pepper, the fruit is collected before maturity and dried. The fruit is about the size of the pepper, but has a stalk-like prolongation which distinguishes it. The pericarp becomes much shriveled and wrinkled on drying.

Cubebs are cultivated in special plantations or with coffee, for which they provide shade by spreading from the trees which serve as their support. Their cultivation is said to be easy.

Cubebs have a pungent, bitter taste and a characteristic aromatic odor. It cannot readily be confounded with any of the other more common spices. Its use as a spice is almost wholly discontinued. The use of cubebs in medicine is also waning, since it evidently has only slight medicinal properties. It is used in nasal and other catarrhal affections.

Cubeb cigarettes are used in the treatment of nasal catarrh. It has a marked influence upon the kidneys, causing irritation and increased activity, and, as already indicated, it is, therefore, a diuretic. It is, however, harmful

1
2
3
4
5
6
A
B
C
7
8
9
10
11
12
13
14
15
16
17
18
19
20

rather than beneficial in acute inflammatory conditions of these organs.

Description of plate: A, twig with staminate flowers; B, fruit-bearing twig; 1, upper portion of staminate inflorescence; 2, staminate flower; 3, fruit; 4, 5, 6, 7, ovary; 8, 9, seed.

HOPS

The Hop has been called the Northern vine. It is found in a wild state throughout Europe, excepting the extreme North, and extends east to the Caucasus and through Central Asia. It is a handsome plant and not infrequently used as an arbor plant. The lower or basal leaves are very large, gradually decreasing in size toward the apex.

Hops is also cultivated in Brazil and other South American countries, Australia, and India.

The principal use of hops is in the manufacture of beer, to which it imparts the peculiarly bitter taste, and its repute as a tonic. For this purpose enormous quantities are consumed in Germany and England. The exhausted hops from the breweries form an excellent fertilizer for light soils. The leaves have been used as fodder for cows. Leaves, stems, and roots possess astringent properties and have been used in tanning. In Sweden the fiber of the stem is used in manufacturing a very durable white cloth, not unlike the cloth made from hemp and flax.

Hops is used medicinally. It at first causes a very slight excitation of brain and heart, followed by a rather pronounced disposition to sleep. Pillows stuffed with hops form a very popular domestic remedy for wakefulness.

Hop bags dipped in hot water form a very soothing external application in painful inflammatory conditions, especially of the abdominal organs. It has undoubted value as a bitter tonic in dyspepsia and in undue cerebral excitation.

Description of plate: A, staminate (male) inflorescence; B, pistillate (female) inflorescence; C, fruiting branch; 1, staminate flower; 2, perigone; 3, stamen; 4, open anther; 5, pollen; 6, pistillate catkin; 7, 8, 9, pistillate flowers; 10, scales; 11, 12, 13, scales and flowers; 14, 15, fruit; 16, 17, 19, seed; 20, resin gland (lupulin).

DANDELION

Dandelion is a perennial herb thoroughly familiar to every one, as it is found almost everywhere throughout all temperate and north temperate countries.

The poor of nearly all countries collect the young, crisp leaves in the early spring and prepare therefrom a salad, resembling lettuce salad.

The leaves are also cooked, usually with leaves of other plants, forming "greens," highly relished by many people.

The principal use of this plant has thus far been medicinal, but its value as a curative agent certainly has been overrated. It has been used in dropsy, pulmonary diseases, in stomach derangements, in hepatic or liver disorders, in icterus, blotchy skin, and other skin diseases, for biliary calculi, in hypochondriasis, etc. It has no marked curative properties in any disorder. Beyond mildly laxative and tonic properties, it has no effect whatever. Using taraxacum preparations for a considerable length of time causes diges-

COPYRIGHT 1902, BY A. W. MUMFORD, CHICAGO

DANDELION

COPYRIGHT 1900, BY A. W. MUMFORD, CHICAGO

tive disorders, mental excitement, vertigo, coated tongue, and nausea.

In lawns, the plant proves a great nuisance, as it displaces the grass, and it is difficult to exterminate. The plants must be dug up, roots and all, carted away, and burned. This should be done early, before the seeds are sufficiently mature to germinate. For medicinal use the roots are gathered in March, July, and November, cleaned, the larger roots cut longitudinally, dried, and packed, to be shipped to points of consumption. The juice expressed from the fresh roots is also used.

COCA

Coca and Cuca are South American words of Spanish origin, and apply to the plant itself as well as to the leaves. The plant is a native of Brazil, Peru, and Bolivia. It is a shrub varying in height from three to ten feet. The leaves resemble the leaves of tea in general outline. The margin, however, is smooth and entire, the leaf-stalk (*petiole*) short; upper and lower surfaces smooth; they are rather thin, leathery, and somewhat bluish-green in color. The characteristic feature of the leaf is two lines or ridges which extend from the base of the blade, curving out on either side of the midrib and again uniting at the apex of the leaf. The flowers are short-pedicled, small, perfect, white or greenish-yellow, and occur singly or in clusters in the axil of the leaves or bracts. The shrub is rather straggling and not at all showy.

The plants are grown from seeds sown in pots or boxes,

in which they are kept until they are from eight to ten inches high, after which they are transplanted during the rainy season. Coca thrives best in a warm, well-drained soil, with considerable atmospheric moisture. In the Andes region an elevation of 2,000 feet to 5,000 feet is most suitable. The young growing plants must be protected against the heat of the sun. The maximum growth is attained in about five years.

The leaves are the only parts used, although the active principle, cocaine, is present in small quantities in all parts of the plant. As soon as the shrubs are several years old the leaves are picked, usually several times each year.

Coca leaves have been used for many centuries by the natives of South America, who employed them principally as a stimulant, rarely medicinally.

Description of plate: A, flowering branch; 1, bracts, enlarged; 2, flowering bud; 3, flower; 4 and 5, petal with ligula; 6, pistil with stamens; 7, stamen; 8, pistil; 9, ovary, transverse section; 10 and 11, corolla; 12 and 13, fruit.

THE POPPY

The opium-yielding plant or Poppy is an herb about three feet in height; stem of a pale green color, covered with a bloom. Branches are spreading, with large, simple, lobed, or incised leaves. The flowers are solitary, few in number, quite large and showy. The four large petals are white or a pale pink color in the wild growing plants. The fruit is a large capsule, one to three inches in diameter, of a depressed globular form. The seeds are small and very

POPPY.

(Papaver.)

COPYRIGHT 1900, BY A. W. MUMFORD, CHICAGO

A. White Poppy. B. Carnation Poppy. 1. Pistil and Stamens. 2. Stamens (magnified). 3. Grain of Pollen. 4. Pistil. 5. Cross section of Pistil. 6. Ripe Capsule. 7, 8 and 9. Seed.

numerous, filling the compartments of the capsule. In spite of the general attractiveness of the plant, the size of the flowers, and the delicate coloring of its petals, it is not a favorite at close range, because of a heavy nauseating odor which emanates from all parts of the plant, the flowers in particular. The petals, furthermore, have only a very temporary existence, dropping off at the slightest touch.

The wild ancestor of our familiar garden poppy is supposed to be a native of Corsica, Cyprus, and the Peloponnesian Islands. At the present time it is extensively cultivated everywhere, both as an ornamental plant and for its seeds, pods, and the yield of opium. It has proven a great nuisance as a weed in the grain fields of England, India, and other countries—something like mustard in the oat fields of the Central States. There are a number of forms or varieties of the cultivated poppy. The red poppy, corn poppy, or rose poppy is very abundant in southern and central Europe and in western Asia. It has deep red or scarlet petals and is a very showy plant. The long-headed poppy has smaller flowers of a lighter red color and elongated capsules, hence the name. The Oriental poppy has very large, deep red flowers on a tall flower-stalk.

Description of plate: A, flowering plant, white variety; B, flower of red variety; 1, pistil and stamens; 2, stamen; 3, pollen grains; 4 and 5, pistil; 6, ripe capsule; 7, 8, 9, seed.

LICORICE

The licorice-yielding plant is a perennial herb with a thick rootstock, having a number of long, sparingly branched roots and very long runners or rhizomes. It belongs to the same family as the peas and beans. It has purplish flowers with the irregular corolla characteristic of the family. The pods are rather small, much compressed, each with from two to five seeds.

The plant is in all probability a native of the warm parts of the Mediterranean region. There are several varieties, all of which are more or less extensively cultivated and placed upon the market.

Licorice is extensively cultivated in Greece, Italy, France, Russia, Germany, the Danubian Provinces, southern China, northern Africa, and to some extent in England. In the Italian province of Calabria, licorice is planted with peas and corn. In the course of three years the roots are collected, the juice expressed, and the root evaporated to the proper consistency for shipping. New crops are grown from cuttings of the rhizomes. There is an excellent quality of licorice grown in the vicinity of Smyrna. The principal commercial varieties are grown in Spain, southern Russia, Turkey, and Italy. Spanish and Russian licorice root is dried and shipped in bales or bundles. Spanish licorice root is unpeeled and occurs in pieces several feet in length. Russian licorice is usually peeled. Most of the licorice used in the United States is obtained from Italy, Russia, and Germany.

LICORICE.

A. W. MUMFORD, CHICAGO

FROM KŒHLER'S MEDICINAL-PFLANZEN.

IRISH MOSS.

CHICAGO:
A. W. MUMFORD, PUBLISHER.

4

Chondrus crispus.

Gigartina mamillosa.

Some of the licorice found upon the market is quite fragmentary and very dirty. The licorice raised in England is intended for home consumption and is placed upon the market in both the fresh and dried state. The fresh roots have an earthy and somewhat nauseous odor.

Description of plate: A, flowering portion of plant; 1, flower; 2, 3, 4, parts of the flower; 5, stamens; 6, stigma; 7, ovary; 8, fruit; 9, one valve of pod with seeds; 10, 11, 12, different views of seed.

IRISH MOSS

Chondrus crispus, the plant of our sketch, is a sea weed of the Atlantic. It is quite plentiful along the shore lines of the Atlantic States, Ireland, and England. It is commonly known as Irish Moss, though it is not a moss at all. It is also known as Carrageen Moss or Carrageen. It is a perennial plant, three to ten inches high, consisting of a flat, much-branched thallus, as shown in the illustration. It is variable in its coloring, greenish-purple, purplish-brown, grayish-purplish-brown, etc., somewhat waxy or translucent in appearance. It is also very variable in form, no two specimens being exactly alike. It attaches itself to rocks, pebbles, and boulders by means of a basal disk which serves merely as a mechanical support, the frond or thallus absorbing its nourishment from the sea water. In consistency the plant is cartilaginous, mucilaginous, and is entirely dissolved on boiling. When dry it becomes very hard, brittle, and elastic and assumes a light-yellowish, translucent appearance. *Chondrus crispus* is closely similar to *Gigartina*

mamillosa, another sea weed, with which it is usually associated.

Irish moss is extensively collected along the coast of Massachusetts, the plants being spread high up on the beach to dry and bleach in the sun. Its principal use is in medicine, although it has, perhaps, no curative properties in itself. It is a demulcent and emollient, that is, the mucilage present tends to allay irritation of inflamed mucous membranes, as in sore throat, pulmonary complaints, etc. It has been extensively employed as a popular remedy in dysentery, kidney troubles, and pneumonia. Its principal use at the present time is as an article of diet, in the preparation of soup, blanc mange, and jellies. Sometimes it is combined with chocolate or cocoa, sugar, lemon juice, etc., to improve the flavor.

Description of plate: A, B, C, D, different forms of Irish moss; E, F, forms of *Gigartina mamillosa;* 1, section of thallus of *G. mamillosa;* 2, 3, 4, sections of *Chondrus crispus.*

CHAPTER IV

FORESTS

JOHN M. COULTER, PH. D.
Head Professor of Botany, University of Chicago

FORESTS have always been admired, and in ancient times they were often considered sacred, the special dwelling-places of gods and various strange beings. We can easily understand how forests thus affected men. There is a solemnity about them, a quiet grandeur, which is very impressive, and the rustling of their branches and leaves has that mysterious sound which caused the ancients to people them with spirits. We still recognize the feeling of awe that comes in the presence of forests, although we have long since ceased to explain it by peopling them with spirits.

Once forests covered all parts of the earth where plants could grow well, and no country had greater forests than North America. When America was discovered, there was a huge, unbroken forest from the Atlantic west to the prairies. Now much of this has been cut away, and we see only small patches of it. Men must use the forest, and still they must save it, and they are now trying to find out how they may do both.

Forests are sometimes almost entirely made up of one kind of tree, and then they are called "pure forests." Pine and beech forests are examples of this kind. More common with us, however, are the "mixed forests," made up of many

kinds of trees, and nowhere in the world are there such mixed forests as in our Middle States, where beech, oak, hickory, maple, elm, poplar, gum, walnut, sycamore, and many others all grow together.

Probably the densest forests in the world are those in the Amazon region of South America. So dense are they that hardly a ray of light ever sifts through the dense foliage, and even at noon there is only a dim twilight beneath the trees. The tallest forests are the eucalyptus forests of Australia, where the trees rise with slender trunks to the height of four or five hundred feet. But the largest trees in the world, when we consider both height and diameter, are the giant "redwoods" (*Sequoias*) of the Pacific coast. All concede, however, that the most extensive, the most varied, and the most beautiful forests of the world are those of the Atlantic and Middle States.

Perhaps it is well to understand how a tree lives, that we may know better what a forest means. The great roots spread through the soil, sometimes not far from the surface, at other times penetrating deeply. The young root tips are very sensitive to the presence of moisture, and turn towards it, no matter in what direction it may carry them. In penetrating the soil, the sensitive root tips are turned in every direction by various influences of this kind, and as a result, when the root system becomes old, it looks like an inextricable tangle. All this tangle, however, but represents the many paths that the root tips followed in their search for the things which the soil contains.

Roots are doing two things for the tree: They anchor it firmly in the soil, and also absorb material that is to help in

COPYRIGHT 1900, BY A. W. MUMFORD, CHICAGO

the manufacture of food. It is the older roots that have long since stopped absorbing that are the chief anchors. How firm this anchorage must be, we can, perhaps, imagine when we think of the strain produced by a great crown of leaves swaying back and forth in the wind. It is only a cyclone that seems to be able to overthrow a sound tree, and then it more commonly breaks its trunk than uproots it.

The very important work of absorbing is given over to the very young roots — in fact, chiefly to those of this year, for new rootlets must be put out each year. These roots can only absorb water, so that if they are to get anything from the soil, it must be something that water will dissolve. In this way the water is used as the carrier of soil-material into the root. Just how this water carrying soil-material gets into the root, is not easy to explain, for the root has no holes to let it in, and it must pass through living walls. That it does enter, however, every one knows. It is evident, therefore, that the root is supplying to the tree two kinds of raw material for food manufacture, obtained from the soil — namely, water and soil-material dissolved in it.

But the tree does not obtain all its raw material from the soil. A very important material is taken from the air, the material commonly called "carbonic acid gas," the same material that we breathe out so abundantly from our lungs as one of our body wastes. This important material is taken out of the air into the plant chiefly by means of the leaves. Spread out as they are in the air, the leaves are in the most favorable position for doing this work.

But where and how are these three kinds of raw material manufactured into plant food? The leaves are specially

constructed to be the chief seat of this food manufacture. The carbon gas is received directly into these manufactories from the air, but the water and the soil-material are down in the roots, and it is necessary for them to be carried to the leaves. As a consequence, a "current" of water containing soil-material ascends from the roots, through the stem, and is distributed through the branches to the leaves. This movement is generally known as the "ascent of sap." The path of this movement in the stem is through what is known as the "sap wood," and it is this very fact which gives to this region of the wood its peculiar character. Just how the sap ascends through the stem and reaches the leaves, no one knows. All of our explanations have proved unsatisfactory, and only those who are not fully acquainted with the facts claim to be able to explain it.

When the sap reaches the leaves, the water is no longer needed as a carrier of soil-material. Some of it is needed in the manufacture of food, but by far the greater part of it escapes from the leaves into the air by a process which may be called "plant evaporation." The amount of water thus brought from the soil and poured out into the air by active plants is very great; and when we consider a forest at work, we can hardly compute the vast amount of moisture which it is constantly contributing to the air during the growing season.

The three kinds of raw material thus brought together chiefly in the leaves are there manufactured into plant food. On account of this work the leaves have often been spoken of as the "stomachs" of the plant. This is a very incorrect and misleading illustration, for the work referred to is not

POLISHED WOODS.

COPYRIGHT 1900, BY A. W. MUMFORD, CHICAGO

Hungarian Ash.
Cherry.
Mahogany.

White Walnut.
Bird's-eye Maple.
Oak.

(Opp. 1644)

digestion such as a stomach is concerned with, and, in fact, it is a process entirely unknown to animals, and found only in green plants. It is a wonderful process, which we do not at all understand, but it consists in taking this dead raw material from soil and air and manufacturing out of it living material. Not only does the food of the plant, and hence its life, depend upon this process, but all the life of the world, as we understand it, depends upon it. We know at least two prominent conditions of this process, for it seems evident that it cannot take place without light and the peculiar green substance which gives the characteristic color to leaves. With the help of light and this green coloring substance, known as "chlorophyll," the living substance in the leaves is able to do this marvelous work.

The food thus manufactured is distributed throughout the tree, either to be used wherever growth is going on, or to be stored up. While we may say that there is an "ascending current" of sap through the sap wood, it is an error to say that there is a "descending current." The movement of prepared food has no definite channel, but it is drawn in every direction, wherever needed.

If we now consider the parts of a tree altogether, we may be able to get some notion of the meaning of their positions. The roots must be related to the soil to secure anchorage and raw material for food manufacture. The leaves must be related to the air and light to secure more raw material and help in doing their important work of food manufacture. The stem is simply to carry the leaves well up into the air and sunshine, and has no meaning except as it is related to the work of the leaves. In thus widely

separating the roots and the leaves, the stem must act as a channel of communication between them.

In the tree trunks with which we are familiar, every one has observed the concentric rings of wood that appear in a cross-section. These are usually spoken of as "annual rings," with the idea that one ring is made each year. In consequence of this it is the habit to estimate the age of a tree by counting these rings. Not infrequently it happens, however, that more than one ring may be made in a year, as a ring represents a single season of growth, and there may be more than one season of growth during a single year. It is much better to call them "growth rings," and to recognize the fact that by counting them we may be overestimating the age of a tree.

One of the most noticeable things about the principal trees of our temperate climate is that they "shed" their leaves every year, being covered with foliage during the growing season and bare during the winter. This is known as the "deciduous" habit, and such trees are called deciduous trees, in distinction from "evergreen" trees. This is really a habit brought about by the conditions in which trees of temperate climates must live. The leaves of such trees are broad and thin, fitted for very active work. When the winter comes, they would be entirely unable to endure it. The tree might protect them by giving them narrow forms and thick walls (as in pines), but it would be at the expense of activity during the growing season. It is more economical for the tree to make an entirely new set of leaves each year than to protect the old ones.

Perhaps the most noticeable feature in connection with

the fall of the leaves is that so many of them take on a rich coloration. Our mixed American forest is the most brilliantly colored autumnal forest in the world, and there can be no landscapes richer in color than those which include such a forest. While all this should appeal to our sense of the beautiful, it should raise the question as to what it means in the life of the trees. We are not at all sure that we know, for we cannot as yet explain the conditions which cause the colors to be produced. We observe that they occur towards the end of the activity of the leaf, but that they are necessarily associated with cold, or drought, or certain outside conditions, is not at all clear. The colors are various shades of red and yellow, sometimes pure, sometimes mixed. It has been suggested recently that the red color is to serve as a protection. It is known that before the fall of the leaf the living substances are gradually withdrawn into the permanent parts of the tree, and that when these living parts cease to work they are peculiarly helpless. At this unprotected period the red appears, and this color absorbs enough heat from the light to raise the temperature, and so the needed protection against chill is afforded. This seems reasonable; but the whole subject of the meaning of plant colors is very obscure.

CHAPTER V

FRUITS, NUTS, ETC.

BROADLY speaking, Fruits are as multitudinous in variety as are the species of flowering plants upon which they grow. When the term fruit is used in ordinary language, we generally have in mind those fruits which are edible for man, and it is in this restricted sense that the term is here applied.

Edible fruits are found in all countries and grow upon a great variety of flowering plants. They resemble each other in that they contain a high percentage of water, holding in solution acids, sugar, and other substances in variable quantity. Sub-tropical and tropical countries are usually considered the chief fruit countries. It would be more correct to state that all countries yield fruits in abundance, though each zone has fruit plants peculiar to it.

Botanically considered, a fruit consists of the matured or fully developed ovary enclosing the ripened seeds. According to this definition, apples, pears, quince, pomegranate, strawberry, and others are not true fruits. Apples, pears, etc., consist largely of the modified fleshy calyx, and the strawberry is a much-thickened torus, or receptacle. In some cases only a part of the fruit is edible. There is an outer thin covering, commonly known as the peel, which is often eaten, but which would better be removed by peeling, as it is indigestible and may cause trouble. In some cases (banana, orange, lemon) the peel is very thick and wholly

inedible. In the case of peach, cherry, and plum, the hard endocarp (shell) is inedible. In case of nuts, so called, the seed is the edible portion, while that part of the fruit belonging to the ovary (as hull and shell) is wholly inedible. These nut seeds resemble each other in being very rich in oil and comparatively dry. They are, therefore, difficult to digest and should be eaten only in small quantities at a time.

Most of the stone fruits are not especially palatable, hence they are generally rejected, except such as the sweet almond. ALBERT SCHNEIDER.

THE APPLE

The ancients better appreciated the importance of the Apple than do the moderns, who treat it chiefly as "the embryonic condition of cider or as something to be metamorphosed into pies." It is said to be indigenous to every part of the inhabited globe except South America and the islands of the Pacific. It is equally at home in the fierce heat of the equator and among the frosts of Siberia. In olden times the fig was the index of a native civilization. Later on, the vine was king, but at the present time there are many who maintain that the apple is the only genuine index of civilized man, and claim that it flourishes best in those regions where man's moral and intellectual supremacy is most marked.

The Athenians made frequent mention of the cultivation of the apple, and Pliny enumerates twenty varieties that were known in his day. It is generally supposed that the Goths and Vandals introduced the manufacture and use of

APPLE BLOSSOMS.
(Pyrus Malus).
About Life-size.

COPYRIGHT 1900, BY A. W. MUMFORD, CHICAGO

APPLES.
(Jonathan.)

COPYRIGHT 1901, BY A. W. MUMFORD, CHICAGO

cider into the Mediterranean provinces, and references to it are made by Tertullian and the African Fathers. The use of cider can be traced from Africa into the Biscayan provinces of Spain, and thence to Normandy. It is supposed to have come into England at the time of the conquest, but the word "cyder" is said to be Anglo-Saxon, and there is reason to believe that it was known in the island as early as the time of Hengist. As the mistletoe grew chiefly on the apple and the oak, the former was regarded with great respect by the ancient Druids of Britain, and even to this day, in some parts of England, the antique custom of saluting the apple trees in the orchards, in the hope of obtaining a good crop the next year, still lingers among the farmers of Devonshire and Herefordshire. During the Middle Ages the fruit was made the pretext for massacring the oppressed tribes of Israel, as it was supposed that the Hebrews used apples to entice children into their homes to furnish their cannibal banquets.

The different varieties of apples have all descended from a species of crab found wild in most parts of Europe. Although there are two or three species of wild crab belonging to this country, yet none of our cultivated varieties have been raised from them, but rather from seeds of the species brought here by the colonists from Europe — over two hundred varieties of apples are known at the present time. As a rule, the apple is a hardy, slow-growing tree, with an irregular head, rigid branches, roughish bark, and a close-grained wood. It thrives best in limestone soils and deep loams. It will not flourish in wet soils or on those of a peaty or sandy character. As a rule, the trees live to be

fifty or eighty years of age, but there are specimens now bearing fruit in this country that are known to be over two hundred years old.

The wood is often stained black and used as ebony. It is also made into shoe lasts, cog-wheels, and small articles of furniture, and is greatly prized in Italy for wood carving and statuary.

New and choice varieties of apples are derived from seeds planted to produce stocks. One stock in ten thousand may prove better than the original, and its virtues are perpetuated by layers, cuttings, graftings, and budding. The tree is not subject to disease. Insects, notably the borer, the woolly aphis, the caterpillar, the apple moth, and the bark louse, have to be guarded against, and several blights occasionally attack the foliage, but as a rule small loss is experienced from these sources. CHARLES S. RADDIN.

THE PEACH

The Peach is one of the most important and best-known fruits.

It is not found in the wild state in its present form, though in some localities it propagates itself, having escaped from cultivation.

It is probably a native of China, where it has been cultivated for centuries and where it is said to reach its greatest perfection.

The number of varieties seems to be unlimited. Over four hundred have been catalogued, though less than one hundred of these are constant. The nectarine is considered

PEACH.
½ Life-size.

COPYRIGHT 1900, BY A. W. MUMFORD, CHICAGO

PEARS.
(Pyrus communis).
Life-size

COPYRIGHT 1903, BY A. W. MUMFORD, CHICAGO

a variety and closely related to the peach and the plum, the apricot, and the cherry.

The tree itself, when bearing its beautiful rose-colored, five-petaled flowers, is highly ornamental. It seldom grows higher than twenty feet and its branches form a symmetrical top. One very ornamental variety produces double flowers and bright, shining leaves, but no fruit.

This valuable plant is generally placed in the family *Rosaceæ,* which includes many species of economic and ornamental importance. Besides those already mentioned, here belong the rose, the strawberry, the raspberry, the blackberry, the apple, the pear, and the quince, as well as many beautiful wild forms.

The thousand or more species usually classed in this family may be readily separated into distinct groups, to which are given distinct family names by some authorities. Thus, the peach, the cherry, the plum, and the almond, which resemble each other in regard to the structure of their fruits and in their chemical constituents, may be placed in a family by themselves. WILLIAM KERR HIGLEY.

THE PEAR

The Pear, like the apple and many other forms of fruit, is an inheritance from remote times and crude beginnings. In a special degree it is a triumph of the horticulturists' skill. The thorns which covered the trees that originally flourished in Syria, in Egypt, and in Greece, have long since disappeared, and the one-time acrid fruit has become metamorphosed into the luscious forms which, under many

varietal names, hold the place of the favorite fruit of modern times.

More than to any other source are we indebted to the French Huguenots for the introduction and cultivation of the pear into this country. Many examples of this early cultivation may still be seen in the old trees in Long Island and New Rochelle, in Michigan and Illinois. The introduction by these people of the French method of propagation upon the quince stock gave an immense impetus to the cultivation of the fruit, as by this process the period of fruiting was reduced from twenty to thirty years to three or four years.

The pear, like the apple, peach, plum, cherry, and many other forms, is referred to the *Rosaceæ,* or Rose family. It belongs to the genus Pyrus, which also includes the apple, the crab apple, the mountain ash, and the historical rowan tree. For the most part, the American forms have been derived from the European *Pyrus communis* and the oriental *Pyrus sinensis.* The trees differ in general aspects from the apple tree in possessing a more pyramidal form, in being considerably longer as a seedling plant, and, while less hardy, being longer lived. It is propagated by seeds, cuttings, layers, budding, and grafting, but its sensitiveness to climatic conditions has materially lessened its distribution in the United States.

C. S. Raddin.

COPYRIGHT 1900, BY A. W. MUMFORD, CHICAGO

BANANA.
$\frac{2}{3}$ Natural size.

THE BANANA

The Banana Plant is herbaceous and dies down to the ground after fruiting. The true stem is underground and perennial, sending up new shoots each season, which grow rapidly and in a few months bear ripened fruit.

The stalk that bears the flowers grows to a height of from fifteen to twenty feet and is surrounded by the sheathing bases of the leaves. The flower cluster or spike is terminal and from two to four feet in length and nodding. The oblong leaves are dark green in color, from five to ten feet in length, and from one to two feet in width. The beautifully arching leaves and the pendulous cluster of flowers or fruits form an attractive foliage and make the plant a noted ornament for the garden.

The many varieties of both the banana and plantain, which vary in taste, color, form, and size, are very widely distributed throughout the world, being usually found in a zone bounded by 38 degrees north and 38 degrees south latitude. It is said that a single plant will produce, on the average, in one year three bunches of fruit weighing fifty or more pounds. The amount of labor required in its cultivation is very small, especially in the older plantations.

The number of bananas on a single stalk of the ordinary variety varies from about one hundred to two hundred, with an average of about one hundred and thirty. When a plantation is fully developed growth is so rapid and so constant that ripe bunches of fruit may be gathered each week.

For the best results a good, fertile soil is required. It is interesting to note that but little moisture is needed, for the plants attract water, either from the air or the waters deep under ground, and the surface of the ground is always moist even in a time of unusual drought.

The stalk that bears the heavy bunch of fruit, occasionally weighing as much as eighty pounds, may be easily cut down by a single stroke of a scythe or a machete.

W. K. Higley.

THE ORANGE*

The tree which produces the well-known Orange of commerce is closely related to the lemon, the citron, and the lime, and with them belongs to the genus Citrus.

The Arabian physicians were familiar with the medicinal virtues of the orange and have spoken of it in their writings.

In more recent years the cultivation of the various varieties has spread throughout the world wherever the climate and the conditions of the soil will permit the ripening of the fruit.

Risso, in his valuable history of the Orange family, enumerates one hundred and sixty-nine varieties with distinct characteristics. Of these, he classes forty-three under the *Citrus aurantium.*

Besides the sweet and bitter varieties, the more common ones are the mandarin orange of China, a flat and spheroidal fruit the rind of which easily separates from the pulp; the tangerine, which is very fragrant and originally derived from the mandarin, and the Maltese, or blood orange, commonly grown in southern Italy and notable for its deep red

399

ORANGES (NAVEL).
(Citrus aurantium).

COPYRIGHT 1901, BY A. W. MUMFORD, CHICAGO

PRESENTED BY LOUIS KUNZE.

407

LEMON.
(Citrus limonum.)

COPYRIGHT 1901, BY A. W. MUMFORD, CHICAGO

pulp. There are many other varieties that bear geographical or local names.

Few forms of plant life present to the beholder more beautiful characteristics than an orange tree in full bearing. Such a tree, in addition to the unripe and ripe yellow fruit, has also numerous white flowers, which give off their wonderful perfume, and its symmetrically arranged branches are covered with rich dark green leaves. It is a tree that appeals not alone to the sense of taste, but to the esthetic nature as well.

THE LEMON

The Lemon is the fruit of a small tree from ten to fifteen feet high. It is not particularly beautiful, being rather shrubby in its appearance. It is an evergreen, bearing leaves, flowers, and fruit all the year round. The flowers occur singly in the axils of the leaves. The calyx is persistent, that is, it does not drop off like the corolla, and may be found attached to the base of the fruit. The corolla consists of five spreading petals of a purplish-pink color.

The lemons of the market are from cultivated plants, of which there are a large number of varieties. These cultivated varieties or forms took their origin from the wild lemon trees native in northern India, in the mountain forests of the southern Himalayas, in Kumoan, and Sikkim.

As the result of cultivation there are now about fifty varieties of lemons in existence. Some of these are comparatively sweet, or rather insipid, and are therefore, known as sweet lemons. The sour varieties are, however, more generally cultivated.

As above stated, the lemon tree bears fruit all the year round, so that a number of crops are gathered annually. There are, however, three principal crops collected, as follows: The first, from July to the middle of September; the second, in November, and the third, in January. Frequently there are also collections in April and in May. The tree is rather delicate; not as hardy as the orange, for example. In upper Italy it even becomes necessary to cover the trees during the winter months. Lemons intended for shipment are picked before they are fully ripe and packed in barrels or boxes holding from four to seven hundred. When exposed the fruit shrinks and loses in weight very rapidly, due to the evaporation of moisture from the pulpy interior.

The following is a description of the excellently colored plate: A is a flowering and fruit-bearing twig, nearly natural size; 1 is a single flower, somewhat magnified; 2, stamens and pistil; 3, ovary in longitudinal sections; 3a, ovary in cross-section; 4, antlers; 4a, pollen-grains; 5, fruit, nearly natural size; 6, cross-section of fruit showing rind, large-celled pulp, and seeds; 7, 8, and 9, seeds.

A. SCHNEIDER.

Originally a native of Asia, the Lemon has become widely distributed in Europe, Africa, and America, and, although far more susceptible to injury from frosts than the orange, the trees are successfully cultivated under many conditions. Doubtless the best results in this country have been obtained in California. Thousands of acres around San Diego are planted with lemon trees, while large districts in the Ojai Valley, Ventura, Santa Barbara, Pomona, and

19

LEMON.

COPYRIGHT 1900 BY A. W. MUMFORD, CHICAGO

LIMES.
(Citrus medica acida).
Life-size.

COPYRIGHT 1904, BY A. W. MUMFORD, CHICAGO

Los Angeles counties are devoted to its cultivation. The tree is remarkable for beauty, and, while it seldom attains large proportions, its pale green leaves, loosely hanging branches, showy and fragrant flowers, together with the fruit that is found in all stages of development, produce a pleasing and highly ornamental effect. While the best crop of lemons is generally gathered between December and April, the fruit should be picked every month for ten months of the year, in order to retain the best results. As a rule, the trees yield from one hundred and twenty-five to one hundred and forty boxes of the fruit to the acre, about the sixth year, but this number is increased to four hundred boxes when the groves reach an age of ten years.

The varieties of lemons are distinguished chiefly by their size and form, and may be roughly classified as egg-shaped with blunt nipples and oblong lemons with large nipples. The sweet lemon and thin-rind Poncine and Naples belong to the first class, while the second includes such forms as the imperial, the Gæta, and the wax. The principal varieties grown in California are the Lisbon, Eureka, and the Villa-Franca. Of these, the Eureka originated in California, while the Villa-Franca was imported from Europe. Besides the grateful quality of the juice, the expressed oil of the rind is used in the arts and has an intense odor of lemon.

C. S. Raddin.

THE LIME

The Lime belongs to the same genus of plants as the orange, lemon, grape fruit, and citron. The lime, lemon, and citron are closely related and are now considered vari-

eties of the same species, the Latin name of which is *medica,* named by the Romans for the country Media. This species is very valuable, having been greatly modified by cultivation.

The lime is the fruit of a bush or low tree which seldom grows higher than twenty feet. The tree will thrive in quite poor and rocky soil. It is more tender than most of the citrus fruits, and can withstand less cold than the lemon. Its cultivation has, for this reason, been abandoned in many localities where the sweet orange seems to thrive.

Several varieties of the lime are cultivated in the United States. The more important of these are the Mexican, which has a small and rather oblong fruit; the Persian, introduced from Persia, which bears a larger fruit; the Rangpur, introduced from India, which bears a fruit resembling the mandarine orange in that the rind is easily separable from the pulp and the carpels may be separated as in the orange. The most highly prized variety is the Tahiti, the fruit of which is quite large and nearly seedless.

In tropical countries limes are more highly prized than lemons for making cooling drinks. They are also used extensively for the manufacture of lime juice and citric acid. The lime is used as a flavor at soda fountains, and is also used to make a drink called limeade.

The juice of the lime is quite extensively used as a preventive of and as a remedy for scurvy. British sailors are sometimes called "lime-juicers," from the fact that "the law requires that the crews be furnished with a weekly allowance of the extract of limes or lemons, as a preventive of scurvy."

GRAPE FRUIT.
(Citrus decumana).
About ⅓ Lifesize.

COPYRIGHT 1904, BY A. W. MUMFORD, CHICAGO

GRAPE FRUIT

The Grape Fruit is a species of the genus Citrus, which also includes the orange, lemon, lime, and citron. Accounts vary regarding its origin, but it is generally supposed to be a native of the islands on the southern coast of Asia.

The grape fruit is really a monstrous orange. The fruit is from four to eight inches in diameter, and, while in China and Japan its sweet taste has given it the name of sweet ball, as a rule the pulp and juice are sub-acid, or bitter, but withal quite refreshing.

The grape fruit, like all forms of extra development, is more showy than useful. It flourishes in tropical and in sub-tropical countries which are not liable to frost, being far more sensitive to cold than is the orange. Florida seems peculiarly well adapted to the cultivation of this fruit, as well as the varieties used for ornamental purposes only. The tree is a beautiful evergreen with dark shining leaves, against which the clusters of greenish-yellow fruit, which are found on the tree in various stages of development at all seasons of the year, produce a most pleasing and ornamental effect.

The grape fruit trees attain a height of from fifteen to twenty-five feet. The heads of the trees are spreading and the branches armed with prickles. The leaves are somewhat downy underneath and the winged petiols are nearly as broad as the leaves. The white flowers have five petals and five sepals, and the fruit, which is a berry, may attain a weight of fourteen pounds.

The term grape fruit is derived from the fact that the fruit grows in clusters of from three to fifteen, thereby suggesting clusters of grapes.

The trees of the grape fruit are not as liable to disease as are the orange trees. Insects and scales do not attack them to any material extent, and this immunity, together with the advantage of being able to raise the trees from seeds, has tended to the development of many varieties, some of which are of great commercial value.

C. S. Raddin.

THE KUMQUAT

The Kumquat, which is esteemed by many persons a great delicacy, is the fruit of a low bush. It is a native of Cochin-China or China and is extensively cultivated in Japan, California, and Florida. The smooth, angular branches bear a dense foliage of dark green leaves. It is a dwarf member of the citrus group, rarely growing to a height of over eight feet, and is closely related to the orange, the lemon, and the lime. The tree or bush varies greatly in size, but, whether large or small, it will produce a plentiful supply of fruits. As an ornamental pot plant for house decoration it is a beautiful evergreen, blooming freely during the spring and early summer. The flowers, which are like those of the orange tree, are small, sweet-scented, white, and either clustered or solitary in the axils of the leaves. The fruits are orange colored and in form either ovate, oblong, or spherical. The transverse section of the fruit very closely resembles that of the orange and shows either five or six cells and quite large seeds. The pulp is

KUMQUATS.
(Citrus japonica).
¾ Lifesize

COPYRIGHT 1900, BY A. W. MUMFORD, CHICAGO

sour and slightly bitter, while the rind is sweet and somewhat aromatic. Both rind and pulp are eaten and the combination of flavor and taste are greatly admired by many persons.

Two varieties of kumquats are grown in the United States; the Marumi, or round kumquats, and the Nagami, or the oval or oblong forms. The trees that bear the round variety are slightly thorny and the fruits vary from about three-fourths to one and one-quarter inches in diameter. The oval or oblong forms are borne by trees without thorns and have a diameter of from three-fourths to one inch and a length varying from one and one-fourth to two inches. These are more highly esteemed than are the round fruits.

Though eaten while fresh, this fruit is extensively used in making a preserve and marmalade. It is also candied, and is used as a flavor in confectionery.

THE QUINCE

The Quince is the pear-like fruit of a bush or small tree resembling the pear tree. The branches are spreading and of a grayish-green or brownish-green color. The leaves are simple, entire, ovate, with short petioles and distinct stipules. The lower surface of leaves and stipules, as well as the young twigs and the sepals, are densely covered with hair cells, producing a woolly appearance. The flowers develop in May and June and are usually solitary upon terminal branches. Calyx green, with five foliaceous, serrate, reflexed lobes. Corolla of five separate ovate, rather large pink petals. Stamens yellow, numerous (twenty);

five styles and a five-celled ovary. The matured fruit is a pome; that is, the greater bulk consists of the thickened calyx enclosing the ovary. The form, size, and color of the ripe fruit are shown in the illustration. Each cell of the ovary bears from six to fifteen seeds, which resemble apple seeds very closely as to form and color.

On account of its astringency it has been used in dysentery, hemorrhage, and other conditions requiring an astringent substance. At present it is little used, the seeds excepted.

The pulp is fibrous and tough; it is not edible in the raw state on account of its acrid, astringent taste. As a whole, it is a discouraging and disagreeable fruit, in spite of its beautiful yellow color and pleasantly aromatic odor. Mixed with apples, it makes excellent pies and tarts. A marmalade is made from the pulp; also a delicious jelly.

The seeds are extensively used, on account of the mucilage of the outer surface. A decoction commonly known as mucilage of quince seed is much used as a demulcent in certain diseases—in erysipelas, inflammatory conditions of the eyes, and in other affections where mucilaginous applications are found useful. Most of the quince seed of the market comes from southern Russia, southern France, and the Cape of Good Hope. It is cultivated in various temperate and sub-tropical countries.

Description of plate: A, flowering twig; B, fruit; 1, stipules; 2, flower in section; 3, stamen; 4, pollen; 5, style; 6, stigma; 7 and 8, fruit in sections; 9 and 10, seeds of one cell of the ovary; 11, seeds; 12, seed in sections.

ALBERT SCHNEIDER.

LOANED BY LOUIS G. KUNZE, CHICAGO

552

STRAWBERRIES
(Fragaria chiloensis).
½ Life-size

COPYRIGHT 1901, BY A. W. MUMFORD, CHICAGO

STRAWBERRY

Strawberries are small, herbaceous plants belonging to the Rose family. They are perennial, propagating by means of runners. The white flowers have the general characteristics of the apple blossom and the rose; that is, five (double) sepals and five petals, with numerous stamens and pistils.

The word strawberry is both perplexing and scientifically incorrect. The edible part is not a "berry," but the much-enlarged fleshy torus, or receptacle, to which the numerous very small, rather hard fruits (seeds) are attached. It is botanically a "false fruit," and not a berry at all. The green, ten-parted, star-shaped, leafy structure found attached to the base of the so-called berry is the permanent calyx, which is removed before the fruit is eaten.

About six or seven species are natives of the United States, where they grow wild in prairie lands, as well as in the wooded areas.

The numerous culture varieties are derived from a comparatively few of the fifteen wild stock species. The desirable qualities are sweetness, delicacy of flavor, good size, small seeds, and pulpiness.

Strawberries, for successful cultivation, require rich soil in a protected place. They do not yield a full crop until the second summer after transplanting.

Growers must keep in mind the fact that certain plants produce essentially pistillate flowers and others essentially staminate flowers. Staminate plants are not productive, but

are essential in pollination. The yield of berries varies greatly with soil, climate, cultivation, and variety. Under favorable conditions the yield may be over two hundred bushels per acre. A. SCHNEIDER.

THE CHERRY

The Cherry-trees belong to the Rose family and are thus botanically related to the apple, rose, pear, and strawberry.

Cherry trees are cultivated throughout all civilized countries. As with most other long-cultivated fruits, the various varieties are the product of crossing (cross-pollination), artificial selection, and cultivation, and desirable plants are perpetuated by grafting. There are various wild-growing species of cherry, which must not be confused with the cultivated varieties. The wild black cherry is very common in our woods.

The fruit of the cultivated domestic cherry is the most desirable and is usually had in mind when cherries are mentioned.

Cherry wine is made from the fleshy pulp, which has an excellent quality and flavor. Cherry syrup is the product of fermentation and filtration, with the addition of sugar, and is used as a flavor for cold drinks and added to medicines to improve their efficiency and disguise taste. By crushing and distilling the seeds cherry water is obtained. The flowers and fruit stems are employed in kidney and catarrhal troubles. Cherries may be preserved by drying or pickling. The fruits are also macerated in whisky and

CHERRIES.
(Prunus cerasus).
¾ Life-size.

COPYRIGHT 1902, BY A. W. MUMFORD, CHICAGO

ENGLISH GRAPES.
⅔ Life-size.

COPYRIGHT 1900, BY A. W. MUMFORD, CHICAGO

brandy, adding to these drinks an agreeable flavor and acidity. For this purpose the fruit of the wild black cherry is very extensively used. The bark, particularly of the wild black cherry, is extensively employed in medicine. It is a very popular household remedy for the treatment of coughs and colds in children. The gum which exudes from the incised or otherwise injured bark is also used medicinally.

Cherry wood is hard and takes a good polish. It is used in cabinet making, interior finish, and for inlaid work.

Cherries are also employed by the confectioner and by the baker in making pies. The seeds (kernels, pits) are first removed. The habit of swallowing the pits is a dangerous one, as serious and even fatal troubles are caused by them.

A. SCHNEIDER.

THE GRAPE

The name Grape is from the French *grappe,* a bunch of grapes; from the same root as *gripe* or *grab,* to grasp. It is one of the most valuable fruits, not only because of its use in the manufacture of wine, and is the source also from which brandy, vinegar, and tartaric acid are obtained, but because, both in a fresh and dried state, it forms not a mere article of luxury, but a great part of the food of the inhabitants of some countries.

The cultivation of the vine was introduced into England by the Romans, and of late years its cultivation has much increased in gardens, on the walls of suburban villas and of cottages, but chiefly for the sake of the fresh fruit, although wine is also made in small quantities for domestic use.

The cultivation of the vine varies much in different countries. In the vineries of Britain the vines are carefully trained in various ways so as most completely to cover the walls and trellises and to turn the whole available space to the utmost account. The luxuriant growth of the plant renders the frequent application of the pruning-knife necessary during the summer. The bunches of grapes are generally thinned out with great care, in order that finer fruit may be produced. By such means, and the aid of artificial heat, grapes are produced equal to those of the most favored climates, and the vine attains to a large size and a great age. The famous vine at Hampton Court has a stem more than a foot in circumference, one branch measuring one hundred and fourteen feet in length, and has produced in one season two thousand two hundred bunches of grapes, weighing on an average one pound each, or in all about a ton.

C. C. Marble.

THE TOMATO

The Tomato is an herbaceous plant, belonging to the Nightshade family, the same family to which the potato and tobacco belong. It is a native of South America, but is very extensively cultivated in nearly all countries, excepting the cold northern regions.

Botanically, the fruit is a berry, and before ripening is of a bright green color, changing to red in the red variety and to yellow in the yellow variety. The same plant bears flowers and ripe fruits, so that fruits may be gathered for a considerable period.

TOMATOES.
(Lycopersicum esculentum.)

COPYRIGHT 1900, BY A. W. MUMFORD, CHICAGO

EGG PLANT FRUIT.
(Solanum esculentum).
⅔ Life-size.

COPYRIGHT 1902, BY A. W. MUMFORD, CHICAGO

Tomatoes have a peculiar flavor and somewhat acid taste when ripe. The pulp contains many seeds. As with other garden plants, there are numerous culture varieties. Some are no larger than cherries. Some are pear-shaped; others large and flattened at the ends. Some are nearly spherical; others quite irregular. The ripe fruits must be gathered promptly, as they decay very readily and quickly.

At the present time the tomato is very little used medicinally, but is very extensively used as an article of diet. Picked green, they are pickled either alone or mixed with other vegetables. The ripened fruit is prepared in a multitude of ways. Peeled and sliced raw, adding salt, pepper, vinegar and sugar. Boiled in soups, mixed with sauces, baked or fried entire, fried or baked, mashed, mixed with stale bread and seasoned, etc. There is a popular superstition that eating tomatoes to excess cauces cancer. Tomato preserves are highly relished by some. Likewise tomato pies.

The general opinion prevails among scientists, as well as laymen, that the tomato is nourishing and wholesome. It is certainly harmless when ripe, but the green pickled preparations are not nourishing, nor particularly wholesome. The notion that pickles aid digestion is a mistaken one. The spices added may stimulate, but the green-fruit particles are not digestible. A. SCHNEIDER.

EGG PLANT

The Egg Plant, also known as Bringal, Aubergine, Egg-apple, and Mad-apple, is an herbaceous plant belonging to the Night-shade family, therefore kin to the potato

and tomato. It is a tender annual, readily killed by the early frosts. It has rather large, simple, somewhat incised leaves. The fruits are large, egg-shaped, tomato-like in structure, hence berries.

It is quite extensively cultivated in gardens. The seeds are sown in hot beds early in April, but transplanting is not done until about the first of June, when all danger of frost is past. The soil should be very rich and the plants set about three feet apart. Like most transplanted plants, they require shading and watering for a few days. Careful cultivation is required during the entire season. Propping may be necessary to keep the large, heavy fruits from the ground. The Colorado beetle is a very annoying enemy of the growing plants and must be effectually fought to insure a crop.

There are several varieties of egg plant. The purple variety is by long odds the greatest favorite. There are also white and yellow varieties.

Most people consider the properly prepared fruit of the egg plant a delicacy. In some tropical countries it forms an important article of diet. The ripe fruit is prepared for the table by peeling and boiling. After boiling the fruit is sliced, seasoned, and fried until well browned in rolled crackers or bread crusts and a liberal supply of butter. When well prepared it is a very palatable article of diet, but when insufficiently cooked or fried it is indigestible. It does not seem to be prepared in other ways, nor does it seem to have any noteworthy medicinal properties.

A. Schneider.

PINE-APPLE.
½ Life-size.

COPYRIGHT 1900, BY A. W. MUMFORD, CHICAGO

THE PINEAPPLE

This tropical fruit is so called from its resemblance in form and appearance to the cones of some species of pine. The *Bromeliaceæ,* to which it belongs, are a small family of endogenous plants, quite closely related to the canna, ginger, and banana families, and differing from them in having nearly regular flowers and six stamens, all perfect. As the Pineapple has become naturalized in parts of Asia and Africa, its American origin has been disputed, but there is little doubt that it is a native of Brazil, and perhaps some of the Antilles, now a part of the domain of the United States. This fruit is a biennial, with the habit of the aloe, but with much thinner leaves. In cultivation it early produces seeds, but in ripening the whole flower cluster undergoes a remarkable change; all parts become enormously enlarged and, when quite ripe, fleshy and very succulent, being pervaded by a saccharine and highly flavored juice. Instead of being a fruit, in the strict botanical sense of the term, it is an aggregation of accessory parts, of which the fruit proper forms but a very small portion.

The first pineapples known in England were sent as a present to Oliver Cromwell; the first cultivated in that country were raised in about 1715, though they were grown in Holland in the preceding century. The successful cultivation of the fruit was early considered one of the highest achievements in horticulture, and the works of a few years ago are tediously elaborate in their instructions; but the matter has been so much simplified that anyone who can

command the proper temperature and moisture may expect success. C. C. Marble.

THE POMEGRANATE*

The Pomegranate is tree-like, growing to a height of about fifteen feet and in favorable soil even as high as twenty feet. It is probably native in Persia, though it is found in a wild state in all the countries bordering on the Mediterranean Sea. It is also found in China and Japan, and has been brought by man to all of the civilized parts of the globe, where the climate is of a sufficiently high degree of warmth to permit the ripening of its fruit.

This little tree is frequently cultivated not alone for the beauty of its form, but for the beauty of its flowers, which, under cultivation, become doubled and show an increased and striking splendor in the richness of their color.

The pomegranate belongs to the family of plants called *Lythraceæ*. This family has about three hundred and fifty species, which are widely distributed, but are most abundant in tropical regions, especially in America.

The color of the flowers, which develop on the ends of the younger branches, is a deep and rich scarlet or crimson. Many variations have been produced by growing the plants from seeds, and one of these bears white flowers. The petals are rounded and usually crumpled.

The fruit, which is a berry about the size of an ordinary orange, is, when fresh, usually of a reddish-yellow color, becoming brownish in drying. The rind is thick and leathery and encloses a quantity of pulp which is filled

COPYRIGHT 1901, BY A. W. MUMFORD, CHICAGO

POMEGRANATE.
(Punica granatum.)
⅔ Life-size.

PERSIMMONS.
Life-size.

COPYRIGHT 1902, BY A. W. MUMFORD, CHICAGO

with a refreshing juice that is acid. It is of a pinkish or reddish color, and encloses the numerous angular seeds. Probably the chief value of the plant lies in the use of the fruit as a relish, though the rind of the fruit and the bark of the root are used in medicine.

The bark contains a large amount of tannin, and from it there is also obtained a bright yellow dye, which is used to produce the yellow Levant morocco. In regions without frost the tree is often grown for ornamental purposes.

THE PERSIMMON*

The Persimmon, or Virginian Date Plum, is a North American tree, growing wild in nearly all of the southern United States, and will thrive and ripen its fruits as far north as the state of Connecticut and the Great Lakes. It is one of about one hundred and eighty species belonging to the genus *Diospyros*. These are all hardy trees or shrubs. Representatives of the genus are found in nearly all regions that have a tropical or a temperate climate.

Only a few of the species are cultivated. These are highly ornamental trees with a beautiful foliage, which is rarely attacked by insects. The common persimmon of America is the only species that is at all hardy in the north. This and the Japanese species are the only trees that produce the edible fruit commonly found in the market. The wood of nearly all the species of *Diospyros* is hard and close-grained. The trees that yield the beautiful ebony of commerce belong to this genus, and the species that is said to yield the best quality of this wood is a native of the East

Indies and Ceylon. It is also cultivated to some extent in hothouses and in tropical climates.

The common persimmon of the United States is a tree usually growing to a height of about fifty or sixty feet and rarely reaching one hundred feet. This is a beautiful round-topped tree with more or less spreading branches. The name persimmon is of Indian origin and of unknown meaning. The fruit of this species is but lightly appreciated, except by those who visit the forest regions in which it is native, for it is only cultivated to a very limited extent. The fruit is globular in form and quite plum-like. It varies both in size, color and flavor. When green the fruit is astringent and has a very disagreeable taste. This, however, disappears when the fruit becomes fully matured.

THE WATERMELON

The Watermelon is a native of Africa. In fact, Livingston states that in Africa large areas are covered by the plants growing in a wild state, and in New Jersey and Long Island, where large fields are devoted to its cultivation, the plants show a marked tendency to spread spontaneously.

The watermelon belongs to an eminently respectable but not a particularly aristocratic family. Its near relations are the gourd, the cucumber, the pumpkin, and the squash. There is probably no country in which this fruit is so largely cultivated as in the United States, its habitat being limited, however, to the southern and middle portions of North America to the fourth degree of latitude. The short sea-

WATERMELON.
(Citrullus vulgaris).
¼ Life-size.

COPYRIGHT 1904, BY A. W. MUMFORD, CHICAGO

COPYRIGHT 1900, BY A. W. MUMFORD, CHICAGO

Life-size.

Almond
Chestnut
Brazil nut

Filbert
Peanut

Pecan
Hickory nut
English walnut

sons of the more northern states are unfitted for the complete development of the fruit. It is peculiar in the fact that it yields no important by-products, with the exception that its saccharine matter may be converted into sugar. The juices of the fruit cannot be converted into wine or vinegar, and, unlike the cantaloupe, it does not produce a good brandy when distilled.

The plants are annual, trailing, slender vines extending from eight to fifteen feet. The leaves are five-lobed, from three to six inches in length, and in dry countries the plants often supply vegetation when all others are dried up. The leaves are possessed of an unusual perspiratory power, hence they require a greater amount of moisture than the majority of plants, the roots often extending a considerable distance to reach water. C. S. RADDIN.

NUTS*

1. The English Walnut has a thin shell. This nut is much esteemed and is an important article of commerce. It yields by expression a bland fixed oil, which, under the names of "walnut oil" and "nut oil," is much used by painters and is a common article of food.

2. The Peanut is also called Ground Nut and Earth Nut. It is cultivated in all warm regions of the globe, and its usefulness is such that it is likely to extend.

3. The Brazil Nut is a popular nutritious nut grown in Brazil. The large outer shell is filled with nuts, making a most peculiar fruit. The shell is very hard and contains a rich, oily meat in one piece like an almond.

4. The Hickory Nut abounds near the Great Lakes and in some parts of New Jersey and Pennsylvania. The nuts are in considerable demand and are sometimes exported. The shell is thin but hard and the kernel sweet.

5. The Filbert is the fruit of the hazel. The kernel has a mild, farinaceous, oily taste agreeable to the palate. In England filberts are usually large hazel nuts. The American hazel nuts are of two other species.

6. The Chestnut is eaten raw, boiled, or roasted, or is ground into meal, and puddings, cakes, and bread are made from it. The tree is common to Europe and America.

7. The Pecan, sometimes called the Illinois Nut, a species of hickory nut. The shell is thin and the meat well flavored. The tree grows in North America, chiefly in the Mississippi Valley, and in Texas, where it is one of the largest of forest trees.

8. The Almond grows on a tree about twenty or thirty feet high, a native of the East and of Africa, but has now become completely wild in the whole south of Europe.

THE ENGLISH WALNUT AND RELATED TREES

The English Walnut, Butternut, Black Walnut, Shagbark or Shellbark Hickory, Mockernut or Whiteheart Hickory, Bitternut Hickory, and Pignut Hickory are closely related, belonging to the Butternut family. They are large, handsome trees with spreading branches and clean-cut leaves. They are of comparatively slow growth, but hardy and enduring. The English walnut is a tall, large, handsome tree which undoubtedly came from India.

M KŒHLER'S MEDICINAL-PFLANZEN.
)

ENGLISH WALNUT.
(Juglans regia.)

CHICAGO:
A. W. MUMFORD, PUBLISHER.

All the other members of the Butternut family are common throughout the United States, either growing wild or under cultivation. The wood of the butternut or white walnut and that of the black walnut is extensively used in cabinet making, furniture making, and interior finish, particularly the wood of the black walnut. The earlier craze for black walnut furniture threatened to exterminate the plant, but, fortunately (for the walnut tree), the fashion is waning. The wood is heavy, dark brown in color, of medium hardness, easily worked, and readily polished, though it does not take the glossy polish of the harder woods, as ebony. Hickory wood is very hard, tough, and durable, but it is not suitable for cabinet making, etc., because it warps too much. It is an excellent wood for making handles for tools of all descriptions, oxen yokes, hoops, walking-sticks, whiffletrees, wagon stocks, etc. Its tensile strength is enormous, being said to be equal to that of wrought iron.

The seeds (kernels) of the English walnut, butternut, black walnut, and shagbark hickory are edible and greatly relished, while those of the bitter and pignut hickories are not edible. Eating too many of the kernels causes distressing dyspeptic symptoms because of the large amount of oil which they contain. Salting the kernels before eating or taking a little salt with them is said to lessen these disturbances.

Description of plate: A, twig with staminate and pistillate flowers; B, twig with pistillate flowers; C, fruit; 1-6, flowers and floral parts; 7-10, fruit and seed (nut)

A. SCHNEIDER.

THE ALMOND

The Almond is ıe fruit of a small tree belonging to the Rose family. The plant is believed to be a native of northern Africa, Persia, and Turkestan. It occurs wild in Sicily and Greece and is cultivated throughout temperate Europe, including England.

The leaves of the almon. tree are simple, broadly lanceolate, margins serrate, brigh green, and stalked. The flowers are nearly sessile, mostly solitary, petals bright pink; otherwise similar to the flowers of the rose family as seen in the apple blossom, cherry blossom, and the wild rose. The fruit is a drupe or stoı e fruit, resembling the peach in its general structural characters. It is, however, much smaller, measuring about one and one-half inch in length. As in the peach, the outer portion of the fruit coat is fleshy, the inner portion is hard and encloses the kernel or seed to which the term almond usually is applied. The plant is very ornamental, producing its beautiful flowers in March, before the leaves are developed.

Two natural varieties of almonds are quite universally recognized — the sweet and the bitter. They resemble each other so closely in general appearance that it is practically impossible to distinguish between them. The principal difference lies in the chemistry of the kernels or seeds themselves. In the bitter variety amygdalin is found, which is practically wanting in the sweet variety.

At the present time the sweet almond is extensively cultivated in northern Africa, southern Europe, and in the

FROM KŒHLER'S MEDICINAL-PFLANZEN.

368

ALMOND.

CHICAGO:
W. MUMFORD PUBLISHER

Butter-nut.
Edible Pine.
Cross section Black Walnut.
(Opp. 2007)

EDIBLE NUTS.

Cocoa Nut.

COPYRIGHT 1900, BY A. W. MUMFORD, CHICAGO

Butter-nut in husk.
Black Walnut.

warmer parts of the United States, particularly in California. Climatic conditions and cultivation has a great influence upon the quality of the almonds, and we have as a result quite a number of commercial varieties, just as we have commercial varieties of coffee, tea, oranges, etc. The more important commercial varieties are the Jordan, Valencia, Barbary, and California almonds.

Description of plate: A, B, branch with flowers and fruit; 1, 1a, flowers from different trees; 2, 2a, petals; 3, stamens; 4, pollen; 5, stamen; 6, 7, ovary; 8, 9, seed with shell; 10, seed without shell; 11, 12, sections of seed.

A. SCHNEIDER.

THE COCOANUT*

The fruit of the Cocoanut Palm, which is the most useful tree of all its tribe to the natives of the regions in which it grows, is one of the most valuable and important of commercial products. On the Malabar and Corvomandel coasts of India the trees grow in vast numbers; and in Ceylon, which is peculiarly well situated for their cultivation, it is estimated that twenty millions of the trees flourish. The wealth of a native of Ceylon is estimated by his property in cocoanut trees, and Sir Emerson Tennent notes a law case in a district court in which the subject in dispute was a claim of the twenty-fifth twentieth part of an acre of palms. The tree is very beautiful and lofty, growing to a height of from sixty to one hundred feet, with a cylindrical stem which attains a thickness of two feet. It terminates in a crown of graceful leaves. The leaf sometimes attains a length of

twenty feet, consists of a strong midrib, whence numerous long, acute leafllets spring, giving the whole, as one traveler described it, the appearance of a gigantic feather. The fruit consists of a thick external husk or rind of a fibrous structure, within which is the ordinary cocoanut of commerce. The nut has a very hard, woody shell, inclosing the kernel, within which again is a milky substance of a rather agreeable taste.

The cocoanut palm is so widely disseminated throughout tropical countries that it is impossible to distinguish its original habitat. It flourishes with equal vigor on the coast of the East Indies, throughout the tropical islands of the Pacific, and in the West Indies and tropical America. It is most at home, however, in the numerous small islands of the Pacific Ocean.

COCOA

The Cocoa-yielding plant is a tree varying from fifteen to forty feet in height. The main stem or trunk is much twisted and knotty, from which the branches stand out almost horizontally. The bark is thick, rough, and of a cinnamon-brown color.

The chocolate tree is a native of Mexico, Central America, Brazil, and other South American countries. It is now extensively cultivated in most tropical countries of both hemispheres. The West Indian islands have numerous large plantations. It is also found in botanic gardens and greenhouses. There are several cultivated varieties.

The cocoa or cacao-yielding plant must not be confounded with the cocoanut palm or the coca-yielding plant.

COCOA FRUIT.

A. W. MUMFORD, PUBLISHER, CHICAGO

There is perhaps no food substance which is more universally liked than chocolate. Mothers have no small amount of trouble in hiding the household chocolate from the children. With the omnipresent penny-in-the-slot machine, more pennies are credited to it than to the chewing gum. The housewife and baker use it very extensively with chocolate cake. The confectioner uses it very freely, to the great delight of the children.

The principal use to which cocoa is put is in the preparation of a beverage. For this purpose, enormous quantities of chocolate, cocoa broma, and hulls are consumed annually. The drink is prepared by thoroughly triturating the desired amount of chocolate, cocoa, or broma with a small quantity of water, then stirring this into the necessary quantity of boiling milk or water, and boiling for a few minutes, with constant stirring. The oil present gives the drink great nutritive value.

Cocoa butter, which resembles tallow in consistency and appearance, is used in medical and pharmaceutical practice as a salve or pomade for external application in eruptive diseases, as scarlet fever, etc. Cocoa also finds extensive use in medical practice, though it has no marked curative properties.

Description of plate: Fruit and seeds: B, pericarp; 11, showing how seeds are contained in pericarp; 12, cross section of pericarp; 13, 14, 15, 16, 17, seeds.

ALBERT SCHNEIDER.

CORN

Maize, or Indian Corn, also known as Corn, is a plant belonging to the grass family. It usually attains a height of about seven feet, the single unbranched stem being jointed, only slightly tapering, with a central pith and an outer hard tissue to give necessary resistance to heavy winds. Each node (joint) has a single long, sword-like leaf, the lower portion of which encloses the stem (internode) like a sheath. The fruit, known as the "ear," is collective, several hundred individual fruits, usually designated as "kernels," being fastened to the spike, commonly known as the "cob."

At the present time, corn is extensively cultivated in various countries, but nowhere on such an enormous scale as in the Mississippi Valley. The Mississippi corn region, with Springfield, Illinois, as its center, produces annually from 10,000 to 15,000 millions of bushels, or about three-fourths of the total crop of the United States. In the Central States corn is cultivated on a large and simple scale, made possible by the rich soil. One man with four horses cultivates from eighty to one hundred acres, besides oats and other farm products. Corn requires rich, black, loose soil, with good surface drainage, and special climatic conditions. The season must be warm and nights must not be cool.

With perhaps the one exception of rice, maize is the most extensively used grain in the world. In fact, all parts of the plant are used. The leaves form an excellent fodder for horses and cattle. The stalks also are used in paper making

and in fertilizing the soil. The husk is used in mattresses. The most valuable part of the corn is the fruit, generally spoken of as the grain, or kernel. Green corn is highly relished as an article of diet, although its food value is certainly overestimated, as it is hard to digest. For this purpose sweet corn is preferred. A. SCHNEIDER.

WHEAT

The classification of the different varieties of cultivated Wheat has occupied the attention of many botanists and agriculturists. A good selection of seed, according to the nature of the soil, demands intelligence and accurate knowledge on the part of the farmer. If a good variety be grown in poor soil, the result will be unprofitable, while if bad wheat is grown on good soil, the result may be nil. In botanical collections there exist, it is stated, herbarium specimens or other evidences of plants grown in Norway as far north as latitude 65 degrees, in Switzerland at an elevation of 1,200 feet above the Valley of Zermatt (or 6,500 feet above the sea), near the Straits of Magellan, as well as in Teneriffe, the Cape of Good Hope, Abyssinia, Rodriguez, the Philippine Islands, and the Malay Archipelago. These widely separated localities show the great area over which the culture is possible, and illustrate the powers of adaptation of the plant. The requirements of the consumer also have to be considered; for some purposes the soft wheats, with their relatively large proportion of starch, are the best; for others, the hard wheats, with their larger quantity of gluten. With the modern processes of milling, the hard

wheats are preferred, for they make the best flour; and in North America the spring wheats are harder than the winter wheats. The soft wheats are those which are most general in European cultivation, and, as a rule, the beardless varieties, though more tender, are preferred. The bearded varieties are supposed to be hardier; at any rate, they defy the ravages of predatory birds more completely than the unarmed varieties, and they are preferable in countries liable to storms of wind, as less likely to have their seeds detached. Hard wheats are specially employed in Italy for the fabrication of macaroni. Polish wheat is used for similar purposes. Spelt wheats are grown in the colder mountainous districts of Europe; their flour is very fine, and is used especially for pastry making, but, owing to the construction of the grain, it requires special machinery for grinding.

The numerous varieties of wheat now in cultivation have been obtained either by selection or by cross-breeding. In any wheat field there may be observed, on close inspection, plants differing in character from the majority. If seeds of these "sporting" plants be taken and grown in another season, they may (or may not) reproduce the particular variation. If they do, and the same process of selection be continued, the variation becomes in time "fixed," though it is always more or less liable to revert to its original condition.

The production of wheat, with the use of wheat bread, has increased enormously since the extension of railways has made possible the transportation of grain for great distances by land. Of late years the increase of production has been most notable in southern Russia, Australia, India, and North America. A. B. E.

WHEAT HARVESTING IN THE GREAT NORTH-WEST.

COPYRIGHT 1900, BY A. W. MUMFORD, CHICAGO

CHAPTER VI

MUSHROOMS

THERE are few more useful, more easily recognized, or more delicious members of the vegetable kingdom than the common Mushroom. It grows in short grass in the temperate regions of all parts of the world. Many edible fungi depend upon minute and often obscure botanical characteristics for their determination, and may readily be confounded with worthless or poisonous species, but that is not the case with the common mushroom, for, although several other species of *Agaricus* somewhat closely approach it in form and color, yet the true mushroom, if sound and freshly gathered, may be distinguished from all other fungi with great ease. It almost invariably grows in rich, open, breezy pastures, in places where the grass is kept short by the grazing of horses, herds, and flocks. Although this plant is popularly termed the "meadow mushroom," it never, as a rule, grows in meadows. It never grows in wet, boggy places, never in woods or on or about stumps of trees. An exceptional specimen or an uncommon variety sometimes may be seen in the above-mentioned abnormal places, but the best, the true, and common variety of our tables is the product of short, upland, wind-swept pastures. A true mushroom is never large in size; its cap very seldom exceeds four, at most five, inches in diameter. The large examples, measuring from six to nine or more inches across the cap, belong to *Agaricus*

arvensis, called, from its large size and coarse texture, the Horse Mushroom, which grows in meadows and damp, shady places, and, though generally wholesome, is coarse and sometimes indigestible.

The mushroom usually grown in gardens or hotbeds, in cellars, sheds, etc., is a distinct variety, known as *Agaricus hortensis.* This is a compact and inferior form of the true mushroom, or it may indeed be a hybrid or even a distinct species.

The parts of a mushroom consist chiefly of stem and cap; the stem is furnished with a clothy ring around its middle, and the cap is furnished underneath with numerous radiating colored gills. When a mushroom is perfectly ripe and the gills are brown-black in color, they throw down a thick, dusty deposit of fine brown-black or purple spores; it is essential to note the color. The spores, on germination, make a white felted mat, more or less dense, of mycelium; this, when compacted with dry, half-decomposed dung, is the mushroom spawn of gardeners. The stem is firm, slightly pithy up the middle, but never hollow; it is furnished with a floccose ring near its middle; this ring originates by the rupture of the thin general wrapper of the infant plant. On being cut or broken, the flesh of the true mushroom remains white or nearly so, the flesh of the coarser horse mushroom changes to buff or sometimes to dark brown. To summarize the characteristics of a true mushroom: It grows only in pastures; it is small in size, dry, and with unchangeable flesh; the cap has a frill; the gills are free from the stem; the spores brown-black or deep purple-black in color, and the stem solid or slightly

COPYRIGHT 1903, BY A. W. MUMFORD, CHICAGO

CHANTARELLE (Edible).
(Cantharellus cibarius).

pithy. When all these characteristics are taken together, no other mushroom-like fungus can be confounded with it.

A. B. E.

THE CHANTARELLE

The Chantarelle is a well-known and rather common mushroom which grows quite abundantly in woods of spruce and fir, and in wet seasons also in the forests of deciduous trees. Here it may be found growing either in clusters or singly, from June to November. The cap is usually about two to three inches in diameter, but may reach an extreme of five inches; when young, it is rounded or flat on top, but as it grows older it becomes more or less concave and occasionally folded on itself. The plant as a whole has a uniform yellow color, "suggesting the yolk of an egg," and is smooth. The gills are more like veins than are the parallel knife-like projections hanging like "thin laminated curtains" from the undersides of the caps of many of our more familiar mushrooms. In chantarelles they appear like "turgid veins" rather than gills, for they are irregularly branched and extend downward on the stem in an uneven manner. The stem is solid. The flesh is white and firm and has often afforded an agreeable addition to a camp menu of those who enjoy outings in the coniferous woods of Maine, where it grows in great profusion.

The taste of this mushroom when raw is "pungent and peppery," an unpleasant characteristic which disappears when it is cooked. By many, the chantarelle is considered the most delicate and appetizing of all edible fungi.

Elizabeth W. Woodworth.

THE GLISTENING COPRINUS

From April to November, though more commonly in spring and autumn, the Coprinus appear, and it is not an uncommon occurrence when a single stump will yield several crops in a season. Sometimes the group of mushrooms seems to grow directly from the earth and are apparently far from decaying wood. However, there is probably a piece of wood hidden beneath the surface of the ground, upon which this dependent plant is being nourished.

The clusters of the Glistening Coprinus are frequently very large, and contain a number of individual plants. Thus, though the plant itself is small, the whole cluster will furnish quite a harvest. In Europe this mushroom is not included among the edible forms. Dr. Peck suggests that this may be due to its small size, but the abundance and ease with which it may be procured compensate for its lack of size. By those who have eaten it repeatedly without harm it is considered a delicacy, and not inferior to many other species. When raw it has a flavor of nuts.

The genus *Coprinus,* to which the mushroom of our illustration belongs, includes a number of species which are commonly called Ink Caps. All are easily identified, for soon after the spores have matured the plates that bear them are resolved into an inky fluid, especially in damp or wet weather. Their life histories are nearly completed while still beneath the surface of the ground. It is only when their spores are quite mature that they seek the air above the surface, pushing themselves out in the night time, only

GLISTENING COPRINUS.
(Coprinus micaceus).

COPYRIGHT 1903, BY A. W. MUMFORD, CHICAGO

FROM COL. CHI. ACAD. SCIENCES.

MASKED TRICHOLOMA.
(Tricholoma personatum).

COPYRIGHT 1903, BY A. W. MUMFORD, CHICAGO

to melt away in inky drops during the day. Sometimes when the weather is not damp all the parts may dry and the mushroom remain well preserved.

It is only when young that the glistening coprinus should be gathered for food, and the specimens should be cooked immediately, for they are far from attractive when they have turned black. ELIZABETH W. WOODWORTH.

THE MASKED TRICHOLOMA

The Tricholoma of our illustration is one of the well-known edible mushrooms. Many authors of writings on the food mushrooms speak highly of its esculent qualities. Its taste is pleasant and its flavor may be likened to that of veal. The Masked Tricholoma is generally found in rather open woods or on open, grassy places in the woods. It is a fall species, seldom appearing before the first of September, and it is then common, in favorable places, until the time of heavy frosts.

In England the masked tricholoma is often called Blewits, and Dr. Peck tells us that it is called Blue Stem in France, although in our own country the plant has a more violet or lilac than a blue color. Its solid stem is short and stout and not infrequently bulbous at the base. In color the stem is whitish, tinged with lilac or violet, and when young there are fibrils on its surface which quite disappear as the mushroom grows older. Usually the masked tricholoma is solitary in its growth, but it is also found in groups or even in clusters of several individuals. When young the cap is convex and quite firm, but as it grows older it becomes flat

and flabby, and the margins may become wavy. The margin of the caps of miniature plants is incurved and not infrequently covered with whitish particles or with a fine bloom. The cap varies in color, but is generally some shade of tan, gradually changing into a pale lilac near the edge.

ELIZABETH W. WOODWORTH.

THE GREEN RUSSULA MUSHROOM

Mushrooms are plants. They occupy a unique position, however, in the vegetable kingdom. It might be said of these "children of earth" that they toil not, neither do they spin, inasmuch as they take no part in the busy life of the plant world. They must depend for their sustenance on the efforts of other plants. They develop no flowers or seeds, but reproduce by means of spores, which germinate if the peculiar conditions essential to their growth are present.

Our illustration shows an edible form of mushroom whose beautiful colors contradict a prevailing idea that the highly colored forms are poisonous. The plant is known as the Greenish Russula. It can hardly be called green; greenish-gray better describes it. The top is dry and has upon it small warts or patches of the characteristic color. It is at first rounded, then flat, and later may become centrally depressed. It is usually thin and smooth at the edge, marked there with short lines following the direction of the gills. Old specimens will occasionally split at intervals along the edge. The gills are white or nearly so, and are very fragile, being shattered by a slight blow. They are

COPYRIGHT 1903, BY A. W. MUMFORD, CHICAGO.

FROM PAINTING BY A. WOODWORTH.
91

GREEN RUSSULA (Edible).
(Russula virescens).

FLY MUSHROOM Poisonous.
(Amanita muscaria).

COPYRIGHT 1901 BY A. W. MORDOUGALL & CO.
AMERICAN COURTESY CO., NEW YORK

narrow near the stem, hardly reaching it. The flesh is firm and of a creamy-white, the spores being white. The stem is thick, solid, and rather short.

It is not surprising that forms exhibiting such a variety of color and form and mystery of development should have become a subject for myth and story.

Mushrooms are responsible for the fairy rings so often noticed in pastures. They were thought to be formed by the dancing feet of the fairies, but science comes along and replaces the fancy by cold facts.

A mushroom soon exhausts from the soil the food necessary for its growth. Hence its spores must fall beyond this depleted area in order to germinate, and by so doing a ring of toadstools is formed. When they decay the ground becomes fertilized, causing the grass to spring up along the line of the ring with greater luxuriance than elsewhere.

C. S. Raddin.

THE FLY MUSHROOM OR FLY AMANITA

The Fly Mushroom is one of the most dangerous. It grows very abundantly in July, August, and early September. It is attractive in appearance and gorgeous in coloring, but its fair exterior is a snare and delusion. To it and its blood relatives probably may be attributed most, if not all, of the deaths from mushroom poisoning. It is commonly conceded that its family is the only one which is fatally poisonous, although there are others which produce unpleasant illness. This particular member of the family is mentioned because it is very common.

In examining this mushroom, one should not pull it; dig it up carefully and be sure to lift all of it. When matured it will weigh perhaps half a pound. It is usually of an orange-yellow, fading to a pale color at the edge. Sometimes it may be pale yellow, again almost white. You will notice a number of raised, irregular whitish or yellowish spots or patches on the surface at the top. These are characteristic. The top is nearly flat in mature specimens, and sometimes measures eight or ten inches in diameter. If the baby growth is examined it will be noticed that it is almost globular. The gills are white and very regular, and are sometimes slightly tinged with yellow. On the stem there is a sort of ring or collar which is whitish or yellowish in color and of a thin texture. The lower part of the hollow or stuffed stem swells out and is distinctly bulbous at the bottom, and about the base there is a sort of cup or socket from which the stem rises. Above it, the stem is clothed with whitish or yellowish fragments of like texture to the ring. Sometimes these fragments are almost woolly and extend upwards for some distance.

The flesh of this mushroom is white, firm, and very inviting. The gills are rounded at the edge and at the stem. The odor is pleasant and the spores are snowy-white. Altogether, there is nothing to warn the rash experimenter that it is not as good as it looks. You will find these decorative mushrooms in field as well as in woods; long ranks of them file away through the thin grass. Also one may see them standing in all their glowing color in evergreen woods, the fatal poison cup hidden by the deep green moss.

ELIZABETH W. WOODWORTH.

POLYSTICTUS.
(Polystictus cinnabarinus).
⅔ Life-size.

COPYRIGHT 1904, BY A. W. MUMFORD, CHICAGO

THE CINNABAR FUNGUS*

The fungus which we illustrate is not uncommon on decaying portions of oak, basswood, cherry, and other trees of the woods of many localities. It was given its specific name because of its brilliant cinnabar color, by which it may be recognized at quite a distance. Dr. W. S. Moffatt says that over one hundred specimens were found growing on a log in the woods not far from Chicago.

This species belongs to a large and interesting group of the fungi family. *Polyporaceæ* include fleshy, leathery, or woody forms. Dr. Charles McIlvaine says: "Within this large family are found edible species. In the woody species the razor-strop man finds material for his strops; the surgeon, styptics; the peasant, punk to catch sparks from his flint, and the Fourth of July urchin, a fire-holder to light his pyrotechnics. The Chinese have placed some species in their fathomless materia medica, while the polyporus of the locust tree is used in America as a medicine for horses. No fungoid growth is more universal. They are the ever-active preservers of our trees and converters of forest debris." The species illustrated is leathery, and no edible species of its genus have been reported.

THE BRACKET FUNGI

The plants known as Bracket or Shelf Fungi are familiar objects to every lover of nature who frequents our groves and forests. Beginning as small, slightly elevated protu-

berances, or flat, orbicular patches on the bark of a dead tree trunk, log, or stump, they gradually increase in size and assume more or less definite shapes. Some never attain a breadth of more than a third of an inch, while others may ultimately obtain a width of nearly a foot and one-half, and project fully one-half that distance from the surface of the matrix. The most common form, perhaps, is that of a semicircle, the fungus being more or less flattened and attached by its straight edge to the log or stump.

Sometimes the edges are upraised so as to form cup-shaped growths. Several kinds are so thickened that they nearly resemble a horse's hoof in form, while a few others, although classed as "brackets," are merely amorphous masses appearing in a knot hole or wounded place in a log or stump.

The fungus which we illustrate occurs on the trunks of various trees in Canada, the United States, and in Mexico. The plants grow in tufts or clumps. The pilei or receptacles are leathery and thin. At first they are plain; later they are often recurved at the edges. They are villous, with brown, shining zones, and the bases are narrowed and substipitate. The hymenium or fruit-bearing surface of each plant has a pallid brick color, sometimes with reddish or lilac tints. The specimens figured are proliferous; that is, new pilei arise from the edges of those of the preceding season.

WILL SAYER MOFFATT.

SULPHURY POLYPORUS.
(Polyporus sulphureus).
½ Life-size

COPYRIGHT 1904, BY A. W. MUMFORD, CHICAGO

FROM COL. DR. W. S. MOFFATT

A BRACKET FUNGUS.
(Sterium fasciatum).

COPYRIGHT 1904, BY A. W. MUMFORD, CHICAGO

THE SULPHURY POLYPORUS*

This attractive mushroom may be easily known by its bright colors and its clustered mode of growth. Our illustration is a faithful reproduction of beautiful specimens of the Sulphury Polyporus which grew on a living black oak tree about fifteen feet from the ground. Though the habit of this mushroom is to grow only on dead wood, the host of the two illustrated was seemingly sound throughout.

When young, if cut or broken in warm weather, a yellowish juice will exude. The caps overlap each other and are frequently five inches or more in width. The flesh is white and usually not more than one-half an inch in thickness.

The young cap has a yellowish-red or light orange color which fades, as growth continues, to a beautiful yellow color, especially on the margins. A large cluster of the caps of this mushroom with the bright colors and wavy margins form a beautiful picture on the dark background of a stump, a log, or a tree. It is not particular about the kind of wood on which it grows. The dead wood of almost any species of trees may serve as its host, and not infrequently it will grow upon those in an orchard.

The sulphury polyporus is an excellent illustration of the fallacy of the belief that the highly colored mushrooms are all poisonous. It is not only edible, but palatable as well. However, only the young caps should be used as food, for mature specimens are not only tough, but very indigestible, and unpleasant to the taste. Thinly slicing the young caps

and frying them in butter is perhaps the most satisfactory method of preparing this mushroom for the table, though it may be prepared in other ways. This species has a wide distribution. It may be found in the forests or in the orchards; on the dead wood of trees, on the lawn, or anywhere where conditions are favorable for its growth. Though it may be found from May to November, it is more common and grows more luxuriantly in wet weather.

WOODY FUNGI

Among the common fungi which attract a pedestrian during his rambles through a forest, there is one group which has been given the name *Polystictus* by the scientist. This is a genus of bracket-like species which are leathery, woody, or membranous from the very beginning of their growth. They are pore-fungi; that is, the fruiting spores are borne on the inner faces of tubes or pores which form a single layer on the underside of the bracket. These tubes usually appear first near the center of the bracket and gradually develop toward its circumference.

A shell-shaped form occurs on dead twigs and small branches, both of standing and fallen trees of various kinds, especially of walnut and elm. The plants are small, thin, smooth, white, and of a spongy-leathery texture. At the first, they resemble very small shallow cups seated on the surface of the bark. As they increase in size, their shape becomes more or less spiral, the color pallid, and the surface marked by several consecutive furrows. The under surface is yellowish, afterward changing to gray. It is a pretty and

FROM COL. DR. W. S. MOFFATT.

WOODY FUNGI.

COPYRIGHT 1904, BY A. W. MUMFORD, CHICAGO

Upper side.
Lower side.

Common Zoned Polystictus.
(Polystictus versicolor).

Bristly Polystictus.
(Polystictus hirsutus.

Lower side.
Under side.

delicate little species, which is less than an inch in diameter when fully grown.

A parchment-like species is common on tree trunks of all kinds, particularly those of oaks, hickories, and poplars. The plants are thin, leathery, membranous, rigid, hairy, concentrically grooved, and white in color. The fruiting pores are at first a rich violet or purple color, but this color fades with age or upon exposure to sunlight, so that in old specimens the under surface has a dirty brown color. At first, the plants often grow as a layer, covering the tree trunk for a yard or more. From the surface of this layer the bracket-like growths arise, usually at short intervals from each other, and when fully grown may project an inch or more.

W. S. Moffatt.

CHAPTER VII

MISCELLANEOUS PLANTS

PLANT PROTECTION

It is supposed by many that plants are helpless beings, which must submit to all sorts of unfavorable conditions which come upon them. This is far from true, for while plants as a rule are fixed and unable to escape from danger by flight, still they have very many ways of helping themselves.

Prominent among the dangers which come to active green plants are those which arise from too intense light, which may destroy the delicate working substances. Since the leaves are the great working organs in the manufacture of food, they are especially equipped for protection. Those leaves which must work in exposed places have many details of structure which are evidently for guarding them against the ill effects of too intense light. The most striking adaptations, however are those which have to do with protective positions. Under ordinary circumstances, leaves are placed so that their flat faces are exposed to the most intense light. In some cases this is so great a danger that the leaves are set edgewise, the edges being directed upwards and downwards. When a plant assumes this habit, the leaves are said to be in a profile position, and the plants are sometimes called "compass plants." The latter name has come from the fact that such leaves usually point north or south, and

once it was assumed that this position was in response to some mysterious magnetic influence. It is found, however, that it is merely an effort on the part of the plant to protect its leaves from the intense light of mid-day, and at the same time to expose them to the morning and evening rays of much less intensity.

Some leaves, however, have the power of shifting their position according to their needs, directing their flat surfaces toward the light, or more or less inclining them, according to the danger. Perhaps the most completely adapted leaves of this kind are those of the "sensitive plants," whose leaves respond to various external influences by changing their positions. The sensitive plants abound in dry and hot regions, and one of the best known is represented in our illustration. It will be noticed that the leaves of this Mimosa are divided into very numerous small leaflets, which stretch in pairs along the leaf branches. When the time of intense light and dryness approaches, some of the pairs of leaflets fold together, slightly reducing the surface exposure. As the unfavorable condition continues, more leaflets fold together, then still others, until finally all the leaflets may be folded together, and the leaves themselves may bend against the stem. It is like a sailing vessel gradually taking in sail as a storm approaches, until finally nothing is exposed, and the vessel weathers the storm by presenting only bare poles. These are but a few illustrations of the very numerous devices for escaping too intense light and the dangers which accompany it.

One common danger in temperate regions comes from the lowering of the temperature each night, which sometimes

PLANTS PRESENTED BY LINCOLN PARK COMMISSIONERS.

367

Awake.

SENSITIVE PLANT.
(Mimosa pudica.)

Asleep.

COPYRIGHT 1900, BY
A. W. MUMFORD, CHICAGO.

may chill the living substances to the danger point. This is particularly dangerous to seedlings, whose tender structures have not yet developed the ordinary protective coats. In the spring the seed leaves of numerous seedlings may be seen at the approach of night to rise upward and come together, just as the palms of the hand may be placed together over one's head. This reduces the surface of exposure and the danger of chill at least one-half.

Many plants are also observed to protect themselves against rain, as it is necessary for leaves to avoid becoming wet. If the water is allowed to soak in, the work of the leaves is at once interfered with. Hence it will be noticed that most leaves are able to shed water, partly by their position, partly by their structure.

Perhaps the most general preparation for protection in our region is that which is made for the coming of the winter's cold. In many cases plants do not attempt to protect their delicate structures from the severity of winter, but disappear entirely, leaving only well-protected seeds to carry them over into the next growing season. This results in the so-called "annual habit," which has been learned by many plants in order to escape a season of danger. Other plants do not disappear so completely, but everything above the surface of the ground dies, while the plant continues in the form of underground bulbs, tubers, or various thickened structures.

This habit of seeking a subterranean retreat at the approach of some dangerous season is a very good one, and is found in many of our early spring plants. This subterranean habit has a great advantage over the annual habit,

since a seed is very slow in bringing the plant back again, while a bulb can produce its plant very rapidly.

Still other plants preserve more of their structures than either the annuals or the ground-loving plants. For example, most of our trees have cultivated what is known as the deciduous habit, that is, they merely drop their leaves, which are the endangered structures, at the approach of the unfavorable season, and renew them again when the favorable conditions return. It should be remarked that these leaves do not fall because they are broken off, but that in a certain sense it is a process of growing off, which is carefully prepared for.

It is instructive to notice how differently the so-called evergreens, as pines, spruces, etc., have answered the problem of protection against the cold of winter. The evergreens, instead of dropping their leaves, have undertaken to protect them, giving them a small surface and very heavy walls. In this way protection has been secured at the expense of working power during the season of work. Reduced surface and thick walls are both obstacles to leaf work.

To obtain the most striking instances of protection, however, one must examine plants which belong to permanently dry regions, such as may be found in the United States along the Mexican border, or in the regions of tropical deserts. In the first place, it will be noticed that the plants in general produce smaller leaves than in other regions. That this holds a direct relation to the dry conditions is evident from the fact that the same plant often produces smaller leaves in dry conditions than in moist. One of the most

AMERICAN MISTLE-TOE.
½ Life-size.

COPYRIGHT 1900, BY A. W. MUMFORD, CHICAGO

striking features of an arid country is the absence of large leaves. These reduced leaves are of various forms, such as the needle leaves of pines, or the thread-like leaves of certain sedges and grasses, or the narrow leaves with inrolled margins, such as are common in many heath plants. The extreme of leaf reduction has been reached by the cactus plants, whose leaves, so far as foliage is concerned, have disappeared entirely, and the leaf work is done by the surface of the globular, cylindrical, or flattened stems. A covering of hairs is an effective sun screen, and it is very common to find plants of dry regions characteristically hairy. In such regions it is to be observed also that dwarf growths prevail, so that the plant, as a whole, does not present such an exposure to the drouth as in regions of greater moisture. One of the most prominent measures of protection in dry regions is the organization of what are known as water reservoirs. Nearly all plants of such regions have leaves which are known as fleshy, that is, they are thick and juicy, being reservoirs of stored-up moisture which is doled out cautiously according to the needs of the plant, without any wastefulness.

J. M. COULTER.

THE MISTLETOE

Among the plants sacred and closely allied to the mystic life of a portion of the human race there is none more interesting and rich in legend than the mistletoe. This was associated with religious observances before the time of Christ, and is mentioned by our earliest historians.

There are over seventy species of this peculiar plant.

Both the American variety (*Phoradendron flavescens*) and the European, or true mistletoe (*Viscum album*), belong to a family of parasites, so called because they derive their nourishment entirely or in part from some other plant, instead of taking it directly from the soil. Owing to the presence of the green coloring matter *(Chlorophyll)* in the stems and leaves, the mistletoe is not entirely parasitic, but is to a certain extent self-supporting, drawing but a portion of its nourishment from the tree on which it grows.

It is found both on deciduous and on evergreen trees. In some locations in Europe it is especially abundant on the apple tree, and, if in the right climate, there are few tree species which are exempt from serving as its host.

The mistletoe is an evergreen, shrubby plant of slow growth, attaining a length of about four feet, and its duration of life is practically that of the tree on which it grows. The leathery leaves and rugged stems are yellowish-green in color, and, in the axils of the leaves, are the small and insignificant flowers, which ripen about Christmas-tide into pearly white translucent berries.

At Christmas-tide the mistletoe is largely used for decorative purposes, especially in England, where the custom is ancient, and also in our own land, where each holiday season finds more and more of this unique plant gracing chandelier and window, until we, too, may some day find our maids all kissed—"Under the mistletoe bough."

William K. Higley.

PITCHER PLANT.
(Nepenthes)

COPYRIGHT 1900, BY
A. W. MUMFORD CHICAGO.

PITCHER PLANT

Prominent among the carnivorous plants are the Pitcher Plants, whose leaves form tubes, or urns, or pitchers of various forms, which contain water, and to which insects are attracted and drowned. There is a very common pitcher plant in our northern bogs in whose urn-like leaves insects are found drowned, but which does not have such elaborate arrangements for their capture as other forms. Perhaps the most famous of the pitcher plants is one which is common throughout the Southern States. The leaves are shaped like slender hollow cones and rise in a tuft from the swampy ground. The mouth of this conical urn is over-arched and shaded by a hood in which are translucent spots like small windows. Around the mouth of the urn are glands which secrete a sweet liquid, and drops of this nectar form a trail down the outside of the urn. Inside, just below the rim of the urn, is a glazed zone so smooth that insects cannot walk upon it. Below the glazed zone is another zone thickly set with stiff downward-pointing hairs, and below this is the liquid in the bottom of the urn. If a fly is attracted by the nectar drops on this curious leaf, it naturally follows the trail up to the rim of the urn, where the nectar is abundant. If it attempts to descend into the urn it slips on the glazed zone and falls into the water, and if it attempts to escape by crawling up the side of the urn the thick-set downward-pointing hairs prevent. If it seeks to fly away from the rim it flies towards the translucent spots in the hood, which look like the way of escape, as the direction of entrance is

in the shadow of the hood. Pounding against the hood, the fly falls into the water. This southern pitcher plant is known as a great fly-catcher, and is frequently used for this purpose in the South.

The very largest of the pitcher plants is one which grows in the swamps of California, whose leaves sometimes become as much as two or three feet high, the huge pitchers forming the most capacious receptacle for insects of all kinds and sizes. Its general plan is like that of the southern pitcher plant described above, in that it has an overarching hood with translucent spots and a trail of nectar which leads to the dangerous rim. It has become further elaborated, however, in that the hood extends into a gaudy fish-like appendage, whose colors and flapping serve to attract the flying as well as the creeping insects. The pitcher, also, instead of being straight, is spirally twisted, and has a wing-like expansion which serves as a guide in the spiral ascent to the rim, and leads the victim with definiteness and certainty to the region of danger. The fish-tail appendage is also smeared with the nectar secretion, so that any flying insect lighting upon it is enticed under the overshadowing arch and is almost sure of capture.

The most common pitcher plants of the tropics are the Nepenthes, one of which is shown in our illustration. It will be noticed that each leaf when fully formed consists of three distinct regions, namely, the leaf-like blade, which is continued into a tendril which coils around a support, and the tendril in turn ends in a curiously formed pitcher, which has a more or less complete lid. These pitchers are often mottled with bright colors, and as they swing at the ends

CACTI.
½ Life-size.

COPYRIGHT 19

of the tendrils they seem to attract the attention of roving insects. Around the rim of the pitcher a very definite row of glands may be observed, which secrete the nectar to which the insects are attracted. The arrangements within the pitcher are such as have been described for the ordinary pitcher plant. These pitchers of Nepenthes are usually found containing insects, and often very many of them, whose bodies are being slowly digested and the products absorbed by the plant. J. M. COULTER.

THE CACTUS

Because the Greeks in olden times applied the word Cactus to a prickly plant, Linnæus, often called the Father of Botany, gave the same name to our wonderful American growth, and since his time these strange and varied plants have borne this nomenclature.

We can hardly imagine any group of plants more interesting. There are over eight hundred varieties of curious and unexpected forms, bearing tubular or rotate flowers most varied in size and color — white, pink, purple, yellow, crimson, deep red — all beautiful and fascinating, and in our northern country protected in the conservatories. The Night-blooming Cereus is most renowned, most admired of all.

The cacti are commonly found in the United States, in Mexico, and in South America, and some species are cultivated on the borders of the Mediterranean Sea, where the fruit is eaten.

They vary in size from an inch or two in height to enor-

mous growths of fifty or sixty feet *(Cereus giganteus)*, which stand like telegraph poles, sometimes nearly bare, sometimes with many vertical branches, reminding one of a huge candelabra. Then, again, some forms are nearly spherical, while others are long, jointed, and square; one species *(Echinocactus visnaga)* grows about nine feet in height, with a diameter of three feet or more, and a single plant of this species will sometimes weigh a ton. One of our most common forms is flat and broad. This, the Prickly Pear or Indian Fig *(Opentia Vulgario)*, is the only species found as far north as Wisconsin and New York.

As many of the cacti require but little care, they are quite extensively cultivated, not only for the rare beauty of their flowers, but for economic purposes. However, nearly all are worthy of culture because of their peculiar forms. W. K. Higley.

COTTON

Cotton is an important annual plant from which the vegetable fiber of commerce is grown. The different varieties are natives of the tropical parts of Asia, Africa, and America, but are now grown far into temperate zones. The fruit is a three to five celled capsule, springing open when ripe, and containing many seeds wrapped in cotton fiber, one to three inches long, which constitute the cotton of commerce. The best is the long staple silk cotton known as Sea Island cotton, which is grown principally on the islands and coast of Georgia, South Carolina, and Florida. The finest kinds of cloth are spun from Sea Island and Egyptian

SEA ISLAND COTTON

(Gossypium barbadense).

COPYRIGHT 1900, BY A. W. MUMFORD, CHICAGO

1. Flower.
2. Anther.
3. Pollen grain (enlarged).
4. Longitudinal section of ovary.
5. Cross section of ovary.
6. Seed pod opening at the top.
7. Seed and fibers.
8. Seed without fibers.
9. Cross section of seed.
10. Seed (enlarged).
11. Embryo.

cotton. Cotton is also combined with silk, wool, linen, or alpaca in the manufacture of certain kinds of goods. The most perfect system of cultivation is now used in the United States, where most of the cotton of the world is raised. The seed is usually planted in March in furrows. Blooming occurs early in June, and picking usually begins in August and lasts until the frost stops further growth of plants. It is dried and ginned, or separated from the seeds, and packed ready for shipment. The process of separating seed from fiber was formerly done by hand, but the invention of the cotton gin by Eli Whitney in 1793 revolutionized the cotton industry. Formerly the manufacture of cotton in the United States was confined almost exclusively to the New England States, but of recent years thriving factories for the coarser grade varieties have sprung up in the South, and this industry is rapidly growing in importance.

Besides cotton fiber, other by-products of the cotton industry are of great importance. Cotton seed is rich in oil, which is now extensively used in making lard and in other ways. Cottonseed cake is also used as a cattle food and the cottonseed meal is also becoming an important article of food. Pulp is now also successfully made from the cotton stalks, from which is made the finest of writing paper, etc.

INDEX VOLUME IV

	PAGE
Aaron's Rod	75
African Lily	67
Agate	33, 38, 46
Alabaster	53
Allspice	109
Almond	176
Flowering	75
Tree	75
Aluminum	52
Amber	50
Amethyst	33, 38, 56
Anglesite	25
Anther	64
Apple	150
Crab	154
Aquilegia	81
Araceæ	67
Arbutus, Trailing	103
Arrow Head	96
Ash, Mountain	154
Asters	82
Azalea	87
Calendulcea	88
Nudiflora	88
Viscosa	88
Balm, Bee	90
Fragrant	90
Balmony	103
Banana	155
Basanite	49
Bee Balm	90
Beryl	45
Birth Stones	38
Bitter-Herb	103
Bituminous Coal	29
Black Cohosh	97
Black Pepper	117
Black Snakeroot	97
Blood-Root	84
Bloodstone	38, 49
Blue Gentians	94
Blue Spring Daisy	105
Bouncing Bet	102
Brazil Nut	175
Butter, Cocoa	181
Butternut	176
Cactus	207
Calamus	127
Calcite	50
Calcium	52
Calla Lily	67
Calyx	62
Camellia Thea	120
Canada Lily	69
Cane, Sugar	122
Canyon, Grand	18
Horseshoe	18
Carbon, Minerals Containing	28
Carnation	71
Carnelians	48
Carrageen	139
Caryophyllaceæ	102
Cerussite	26
Ceylon Moonstone	52
Chalcocite	25
Chalcopyrite	25
Cherry	166
Syrup	166
Wine	166
Wood	167
Chestnut	176
Chinese Pink	72
Chlorastrolite	39
Chocolate	180
Chondrus Chrispus	139
Chrysoberyl	42
Chrysolite	42
Chrysoprase	49
Cineraria	74
Cineraria Cruenta	75
Cinnamon	109, 110
Sedge	127
Citrus Aurantium	156
Clematis	100
Miss Bateman	101
Erecta	101
Flammula	101
Jackman	101
John Gould	101
Lucy Lemoine	101
Prince of Wales	101
Sir Garnet Wolseley	101
Cloistered Heart	95
Clove	109
Mother of	109
Clove-Tree	111
Cloves	111
Coal, Soft or Bituminous	29
Coca	135
Cocoa	180
Cocoa Butter	181
Cocoanut	179
Cod-Head	103
Coffee	119
Cohosh, Black	97
Columbine	81
Compositæ	74
Copper	28
and Lead Ores	25
Native	25
Corn	182
Corolla	62
Cotton	208
Cotton Fiber	209
Cottonseed	209
Cowslip, English	98
Crocidolite	34
Cross-Pollination	62
Crystalline Quartz	55
Crystal, Rock	56
Cubebs	131
Cuca	135
Cup, Scarlet Painted	79
Daffodils	86

	PAGE
Daisy, Blue Spring	105
Daisies	80
Dandelion	134
Date Plum, Virginian	173
Diamond	29, 37, 38
Digitalin	126
Dog Rose	70
Double Flowers	59
Easter Lily	68
Egg-Apple	169
Egg Plant	169
Emerald	38
English Cowslip	98
Walnut	175
Walnut and Related Trees	176
Epidote	43
Erigeron, Genus	105
Ethiopian Lily	67
Falls, Niagara	19
Family, Heath	103
Feldspar	36, 51
Field Lily	69
Filament	64
Filbert	176
Fire Weed	95
Flag, Sweet	127
Fleur de Louis	89
Flint	49
Flowering Almond	75
Flower-de-luce	89
Flower, Pattern	62
Flowers	59
and Their Invited Guests	59
Double	59
Forests	141
Formation of Minerals and Gems	23
Foxglove	126
Fragrant Balm	90
Fringed Gentian	94
Fruit, Grape	161
Fruits	149
Fungi, Bracket	193
Shelf	193
Woody	196
Fungus, Cinnabar	193
Galena	25
Garnet	38, 44
Gems	23
Minor	39
Genista	86
Gentiana	94
Gentian, Fringed	94
Gentians, Blue	94
Geyser, Old Faithful	18
Gigartina Mamillosa	139
Ginger	109, 114
Goldenrod	72
Canadian	73
Gigantic	73
Solidago Arguta	73
Tall	73
White	73
Grand Canyon	17
Grape	167
Fruit	161
Greenland Primrose	98
Hazel Nuts	176
Head, Arrow	96
Heart, Cloistered	95
Heath Family	103
Helianthus Annuus	80
Heliotrope	49

	PAGE
Hematite	40, 26
Herb, Great Willow	95
Hickory, Bitternut	176
Mockernut	176
Nut	176
Pignut	176
Shagbark	176
Shellbark	176
Whiteheart	176
Hollyhock	93
Hops	133
Hornblende	34
Horseshoe Canyon	18
How the Earth Was Formed	9
Hyacinth	77
Hyacinthus Orientalis	78
Illinois Nut	176
Indian Mallow	92
Pink	72
Plume	90
Iris	88
Florentina	89
Germanica	89
Pallida	89
Pumila	89
Sambucina	89
Versicolor	89
Irish Moss	139
Iron Ore, Spathic	27
Iron Ores	26
Jacinth	77
Jasper	49
Jonquils	86
Kumquat	162
Labiatæ	90
Lady's Slipper	76
Lapis Lazuli	50
Laurel, Mountain	104
Lazuli, Lapis	50
Lead	25, 28
Lemon	157
Licorice	138
Lilium Harrisii	68
Longiflorum	68
Superbum	70
Lily	63
African	67
Calla	67
Canada	69
Easter	68
Ethiopian	67
Field	69
Meadow	69
of the Nile	67
of the Valley	65
Turk's Cap	70
Wild Yellow	69
Lime	159
Limonite	27
Liverwort, Round-Lobed	100
Lythraceæ	172
Mace	109
Mad-Apple	169
Magnetite	26
Maize	182
Malachite	32, 50
Mallow, Indian	92
Marsh	92
Musk	92
Rose	93
Mallows	92
Marble Beds	30

	PAGE
Marble, Vermont	30
Marbles	30
Marsh-Mallow	92
Marsh Pink	96
May-Apple	129
May-Flower	103
Meadow Lily	69
Medicinal Plants	125
Mescal	86
Minerals	32
and Gems, Formation of	23
Containing Carbon	28
Minor Gems	39
Mint, Mountain	90
Mistletoe	203
Molasses	123
Moldavite	39
Moonstone, Ceylon	52
Morning Glory	63
Moss, Carrageen	139
Irish	139
Mother-of-Clove	109
Mountain Laurel	104
Mint	90
Mullein	91
Great	91
Moth	92
Mushroom, Chantarelle	187
Fly	191
Fly Amanita	191
Glistening Coprinus	188
Green Russula	190
Masked Tricholoma	189
Sulphury Polyporus	195
Mushrooms	185
Musk Mallow	92
Narcissus	85
Palt's	86
Native Copper	25
Niagara Falls	19
Nickel	27
Nut, Brazil	175
Hickory	176
Illinois	176
Nutmeg	109, 113
Nuts	175, 149
Hazel	176
Obscurely Crystalline Quartz	48
Oil, Rose	70
Wells	20
Old Faithful Geyser	18
Onyx	49
Opal	39, 41
Opium	137
Orange	156
Orchidaceæ	76
Orchids	76
Ores, Marbles, etc	25
Nickel, etc	27
Ornamental Stones	52
Oswego Tea	90
Otto of Rose	71
Ovary	65
Ovules	65
Pattern Flower	62
Peach	152
Pear	153
Peanut	175
Pepper	117
Black	117
Red	116
White	117
Peppers	109
Perianth	63
Persimmon	173
Pecan	176
Petals	62
Pineapple	171
Pink, Chinese	72
Family	72
Indian	72
Marsh	96
Sea	96
Pistil	65
Plant, Egg	169
Pitcher	205
Protection	199
Plants, Medicinal	125
Miscellaneous	199
Wind-pollinated	60
Plasma	49
Plum, Virginia Date	173
Plume, Indian	90
Pollen	64
Grain	64
Pollination	65
Pomegranate	172
Poppy	136
Prase	49
Precious Serpentine	53
Stones	37
Primrose	98
Greenland	98
Pulque	86
Pyrite	26, 50
Pyroxene	50
Pyrus Communis	154
Sinensis	154
Quartz	32
and the Silicates	35
Crystalline	55
Obscurely Crystalline	48
Rose	56
Sagenitic	56
Smoky	56
Quince	163
Red Pepper	116
Reine de Femmes	78
Rhododendrons	87
Rhodomite	52
Rock Crystal	56
Rose	70
Dog	70
Mallow	93
of Plymouth	96
Oil	70
Quartz	56
Water	70
Ruby	39
Rudbeckia Hirta	81
Sabbatia Tribe	96
Sagittaria	97
Sapphire	39
Saquenitic Quartz	56
Sard	49
Sardonyx	39, 49
Scarlet Painted Cup	79
Sea Pink	96
Sedge, Cinnamon	127
Self-Pollination	62
Sepals	62
Serpentine	34
Serpentine, Precious	53
Shell-Flower	103

	PAGE
Silicates	35
Simpler's Joy	105
Slipper, Lady's	76
Smithsonite	53
Smoky Quartz	56
Snake-Head	103
Snakeroot, Black	97
Soapwort	102
Soft Coal	29
Spathic Iron Ore	27
Spices	109
Spinach	99
Stamens	64
Stigma	65
Stones, Ornamental	52
Birth	38
Precious	37
Strawberry	165
Style	65
Sugar-Cane	122
Sulphide of Iron	26
Sulphur	34
Sunflowers and Daisies	80
Sweet Flag	127
William	72
Tea	120
Black	121
Bohe	122
Campoe	122
Congon	122
Green	121
Gunpowder	121
Hyson	121
Hyson Skin	121
Imperial	121
Linki-Sam	122
Padre Souchon	122
Pecoe	122
Songla	121
Souchong	122
Soulang	121
Twankay	121
Young Hyson	121
Thea, Camellia	120
Thistle	106
Thomsonite	39
Thulite	52
Thyme, Field	128
Oil of	129
Wild	128
Tin	28
Tobacco	130
Tomato	168
Topaz	53, 39
Tourmaline	47, 32
Trailing Arbutus	103
Traveler's Joy	101
Treacle	123
Tree, Almond	178
Chocolate	180
Rowan	154
Tribe, Sabbatea	96
Trillium	63
Turk's Cap Lily	70
Turquoise	40, 39
Turtle-Head	103
Vanilla	118
de Leg	119
Variscite	39
Velvet-Leaf	92
Verbenas	105
Vervain, Blue	105
Violet	99
Virginian Date Plum	173
Virgin's Bower	101
Wake-Robin	63
Walnut, Black	176
English	175
Water, Rose	70
Watermelon	174
Weed, Fire	95
Wells, Oil	20
Wheat	183
White Pepper	117
Wild Yellow Lily	69
Willow-Herb, Great	95
Wind-Pollinated Plants	60
Wood, Cherry	167
Hickory	177
Yellow Lily	69
Zinc	28
Zoisite	52